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COTTON MILL DRIVING.

GENUINE interest seems now to have been aroused in the problem of the electrical driving of cotton spinning mills. As has been pointed out in these columns, no comparison is possible between the cotton mill and the shipyard, or even the engineering workshop, in which any or many machines are liable at any moment to be laid off.

In a cotton mill there is no laying-off of machines, except for the operations of stripping and grinding and doffing, to which operations, or one of them, every machine is subjected in its turn for brief periods only; all the machines in a mill are at work together for so many hours per day, or they are all stopped. The standing of any machines of one class, while all of another class were at work, would be evidence of an error in the relative numbers of machines supplied, of which no firm would be guilty. Some makers of machinery, it is true, have slightly different opinions from others as to the number of cards requisite for each 10,000 spindles on certain average counts, but this is because they prefer to do more or less carding. And a manager always balances the output of each class of machine to fit the output from his spinning room by a few simple changes in certain gears. But he never reduces the spinning frames below their maximum output. If actually short of orders he might stop some frames and an equivalent proportion of preparation, but this condition is abnormal, and the driving of a mill is not laid out with this prospect in view.

What the electrical advocate must bear in mind is the following: No argument must be based on such pictures as have appeared in certain technical papers, depicting samples of old-fashioned gearing. It should be understood that rope gearing only got the better of good toothed gearing because it was accompanied by what was not given to toothed gearing, namely, great fly-wheel effect. It was the better results from heavy rope rims and faster moving engines that turned the scale. Economy of fuel is seriously regarded, but is not allowed to stand before steady turning.

Now there is no difficulty at all in this respect for electrical advocates. All the fly-wheel effect that is wanted can be had, whether the mill is driven from an outside station or from its own plant. It seems probable that the ultimate fight over electrical driving will be between the self-contained factory and the factory driven from outside. Driven by its own machinery, a cotton mill will provide a load factor of 90 per cent., or perhaps even more. A dozen mills driven from a central supply station would hardly improve on the load factor of a single one of them. Each one of the 12 would start about equally stiffly in the morning. All would stop at the same time, but any slight difference in time would be against the load factor of the central station.

But the main argument for the self-contained mill is the heating question. A mill must be artificially heated. How is this to be done in the absence of steam boilers? It is not every mill that can borrow heat from next door, as can the Acme Mill at Pendleton. There are numerous groups of mills, such as, for example, the several mills at Chadderton, which could very well be driven from a central station, and, with

care in the arrangement of steam pipes, heated also. But it would be very difficult to get the management of that group of mills into line to the extent of sacrificing their plant all at once and becoming parties to a common station for power and heat, which cannot buy coal cheaper than each mill can now buy it for itself; and there is nothing to prevent a common coal-purchasing pool from being formed any day by any number of contiguous mills if thereby they can gain advantage. Thus, the self-contained electrically-driven mill appears to possess many advantages over driving from outside, for the provision of heat is so necessary in winter that the majority of mills must have some considerable boiler equipment and a chimney, and there will be a minority of mills only which can draw both heat and driving power from an external source. There is not much inducement so far to go outside for either if one of them must be made within. It seems probable, therefore, that for some time to come the question of electrical driving of new factories will turn upon the local detail of the system to be adopted by a mill with its own power plant.

Old-established factories have each their own problem. In the case, say, of a worn-out steam-power equipment, it might very well pay to buy energy from an outside source, and to continue to use the worn-out boilers for heating purposes, for a boiler, no longer good for 100 or 160 lb. pressure, would endure many years longer at the easy pressure of 40 lb. for heating duty. And an increase of output by electrical driving, and by using the rope-race area, might well justify the change. But in a large new mill, the mill's own plant starts with all the advantage of no waste space, and there is no argument to be founded on adding 20 years to the life of the boilers, and such a mill proposition would probably be better solved with its own plant. No matter in which direction the solution is effected, there will be a benefit to the electrical industry. What we hope to see extended is electrical driving. It matters very little how or where the electrical energy is generated.

The I.E.E. Election of Council.

It is a good many years since an alteration was made in the Articles of the Institution, making it practically possible for members to nominate candidates for the Council in the event of dissatisfaction with the list of names put forward by the Council itself. Previously to that change the matter was entirely in the hands of the Council. We think the change was a wise one, as it gave members, if they chose to take it, a hand in the choice.

This year, for the first time since the change was made, this power is to be exercised. It is contended that there is an insufficient representation of the interests of provincial members, and that in particular the West and South-West part of the country, having Bristol for its centre, is not represented on the Council. It seems to us that there is very little ground for this view. The list of nominations for the new Council which we have published shows, on the contrary, that the interests of provincial members have clearly been specially considered in the Council's own selection; amongst the five nominations for new members of Council there are no fewer than three who represent electrical engineering outside of London, these being Mr. H. Dickinson, of Leeds, Mr. R. K. Morcom, of Birmingham, and Mr. S. L. Pearce, of Manchester; and Mr. Ferranti, the new President, comes in the same category. In addition to these nominations, it should not be forgotten that the Chairman of each of the six Local Sections has a seat and a vote on the Council, so that on the whole it appears that the charge of inadequate representation of provincial interests can hardly be substantiated. In fact, if the matter were gone into numerically, it would probably be found that the provincial members of the Institution, so far as proportional representation was concerned, were rather over than under represented.

If the Bristol district were a very important one electrically, it would no doubt establish a Local Section, and would in that way automatically always have representation on the Council; but we think it has wisely refrained from establishing such a section, as, in order to be successful, a Local Section must have a large number of members to call upon within easy reach of the place or places of meeting, and an inspection of the list of members shows that the number residing in that neighbourhood is small.

We do not, however, think that because a particular place or district has not a special representative on the governing body of such an Institution as ours, it can be said to be unrepresented. There is nothing in the nature of the Institution, or, indeed, in the nature of electrical engineering itself, to prevent the Council, as a whole, from acting wisely in the interests of the members as a whole, wherever they may happen to reside.

We should be surprised to hear that there was anything to support the idea that the interests of members in the Bristol district had been in any way neglected by the Council of the Institution in the past, or that the interests of members elsewhere would be materially benefited by dropping out one name from the list officially put forward in favour of the proposed representative of the South-West country.

The power to contest the wisdom of the Council's choice is an excellent one for the Institution to possess, and as Dr. John Hopkinson said when the first election under the new rule was about to take place, it was not intended to be "a dead letter"; but we must say that, in this case, there is singularly little reason for putting it into force.

Trans-Atlantic Wireless Telegraphy.

On Saturday last, as previously announced, the Marconi Co.'s wireless trans-Atlantic service was opened for public use, and congratulatory telegrams were again exchanged between great personages. We say "again," because the opening of the Marconi trans-Atlantic service has become a pretty familiar occurrence. Nevertheless, it is surprising how enthusiastic the daily Press becomes on each occasion, unmindful of past events.

But in this case we feel that Mr. Marconi is entitled to the heartiest congratulations, for two reasons: the first, that the interruption which took place a year ago was due to the accidental destruction of the station at Glace Bay, which has now been re-established with greater efficiency than before; and the second, that now for the first time he has succeeded in offering a continuous day and night service, open to the public as well as to the Press. In fact, we regard this as the real inauguration of the wireless service, and we sincerely hope that the Marconi Co. has now seen the last of its troubles, and is fairly embarked on successful commercial operation, which cannot fail to confer great benefit upon the public.

There is only one discordant note in this connection—and that is the reiteration of the old cry "No more cables," set going again by the manager of the Marconi Co., who is reported in the daily Press to have prophesied that no new telegraph cables will be laid. This unpleasantly reminds one of the earlier days, with their see-saw oscillations in the price of cable and Marconi shares—profitable to individuals, no doubt, but highly detrimental to the public interests. So long as these uncalled-for attacks are persisted in, some suspicion will attach to their authors. Cannot the Marconi Co. be content to pursue its way in peace?

That Atlantic cables will continue to be used—and laid—is as certain as anything can be in electrical work, despite the crowings of wireless managers; and we most strongly deprecate these windy prophecies, which do no good to anyone, but, on the contrary, may do a great deal of harm.

Cable Rates. The Canadian Senate has approved of the Bill to place cable communication under the control of the Railway Commission, but has amended the Bill so as to permit the Commercial Cable Co. to retain the privileges it at present possesses in Canada by virtue of its special Acts. In a long letter to the Speaker of the Senate, Mr. Ward, general manager of the company, protests against the proposed reductions, pointing out that the cable companies even now barely earn a fair return on their capital, and that they are handicapped by incessant breakdowns of cables caused by steam trawlers and other hostile agencies, causing great loss and expense. Canada already enjoys specially low rates, due to the large volume of American traffic and the connection with Australia. He regards the present rate of 1s. a word as the irreducible minimum, especially for coded telegrams.

Fortunately, the Canadian Act cannot become operative without the concurrence of the British Parliament, which is an extremely remote contingency.

The Japanese Exhibition. We had the pleasure of paying a preliminary visit to the Japan-British Exhibition a few days ago for the purpose of observing the progress that is being made with the preparation of stands and exhibits. The greatest activity was noticeable in connection with a number of the Japanese exhibits, which undoubtedly will prove an attraction to the British public. Many of these are in a forward state, and if the present rate of progress continues, the Japanese display should be well finished by next Thursday week, May 12th, when the Prince and Princess of Wales formally open the Exhibition. As regards the British exhibits, we certainly feel that the advice of the Duke of Norfolk, the president, which was given on page 650 of our last issue, was very necessary. In the Machinery Hall we observed with satisfaction that two or three stands by British electrical manufacturing and contracting firms, and several by general engineering firms, were nearly completed, but we could not help being impressed with the large amount of work that still required to be done on almost every hand. We are, of course, aware that things may bear a very different aspect after a fortnight's hard work, and we hope that the authorities, exhibitors, and whoever else may be responsible, will throw themselves energetically into the work straightaway. We have seen many exhibitions as they have been emerging from the rough into the finished state, and we, with others, last Friday certainly formed the impression that, in view of the nearness of the opening day, there was need of greater British activity. In some departments Japanese supervisors and workmen were, with their customary enterprise, displaying almost feverish haste and remarkable nimbleness in fulfilling their part of the compact.

Tramcar Drivers and the Law of Negligence. There seems to be an impression abroad that, whenever an accident happens in which a tramcar is concerned, the unfortunate tramcar driver should be held to blame. It is to a jury that deciding a question of negligence is usually entrusted, and it is but human nature that, when there is a poor man on one side and a rich corporation or company on the other, the benefit of the doubt is given to the former. It is only when there is a collision between a motor-'bus belonging to a company and a tramcar, that the scales are more evenly balanced; but that by the way. What we wish to draw attention to is the fact that the driver of a tramcar is often called upon to do the best thing possible on an emergency, and if injury results the company cannot be blamed. No one can be held liable for a mere error in judgment. Again, the driver is not always in the best position to see whether there will be an accident if he goes ahead. In such circumstances he is entitled to rely on the judgment of persons who are in a better position. An instance of the application of this principle is furnished by a case heard last week by Mr. Justice Pickford. Two men wheeling a truck saw a tramcar approaching; as there was not enough room to pass, they backed the truck against a wall, the driver coming on "dead slow." The front of the tramcar having passed the truck in safety, one of the men shouted out "Right, O!" The driver then went ahead, but the hind part of the tramcar caught the truck, which pinned one of the men against the wall and injured him. Mr. Justice Pickford held that, upon the above facts, there was not sufficient evidence of negligence to go to the jury. This decision appears to accord with good sense. The accident was due to an error in judgment—not on the part of the driver, but on the part of one of the men in charge of the truck.

Patents in 1909. The twenty-seventh report of the Comptroller-General of Patents, Designs and Trade Marks, with appendices, for the year 1909 has just been issued as a Parliamentary Paper (94). It is the first report of the present Comptroller-General (W. Temple Franks).

The Patent Laws of this country have undergone many and important changes within the last 60 years, and a new feature of this report is the valuable summary of these changes with which it is introduced.

Though the earliest important statute in reference to patents dates as far back as the reign of James I, no great simplification of the procedure for obtaining patents was made until 1852, when a greatly improved Patent Act was passed as a result of the stimulus to invention given by the great Exhibition of the previous year. Under this Act the total cost of a patent was reduced from over £400 to £175. By the Act of 1883 another great advance was made. Every specification was referred to an Examiner to ensure that the description was clear, but no examination as to the novelty of the invention was as yet carried out. This power was first given to the Patent Office by the Act of 1902, all patented inventions within the preceding 50 years being searched by the Examiners for anticipations. No patent, however, could be refused as a result of this examination for novelty; the Comptroller could merely print the numbers of the anticipating specifications on the specification of the inventor who refused to amend. The power of refusal in cases of undoubted identity was at last given by the Act of 1907.

Many other improvements in procedure have been introduced by recent Acts. Among these may be mentioned the power granted to the Comptroller to revoke within four years of the date of the patent, any patent not adequately manufactured in this country. It is still doubtful whether this power will be beneficial or the opposite to the trade of the country. There have been 73 applications to revoke under this Section (27) of the Act, and 17 patents have been actually revoked, so that the authorities are evidently very cautious in the application of a principle which looks suspiciously like a lapse from the Free Trade policy of this country.

The report gives some interesting data about the trend of invention in 1909. Patents in reference to aeronautics, as we might expect, have increased enormously, the number of applications being three times that of the preceding year. Patents connected with locomotion still occupy a predominant position in the field of inventive activity, speed indicators and signals having especially attracted an increased amount of attention. Inventions for the mechanical handling of materials by conveyors and transporters are much in evidence.

The number of applications for patents in 1909 was 30,603, which appears from the table in the report to be a record.

Notwithstanding the great increase of expenditure involved by the examination of patents for novelty, the receipts of the Patent Office are still nearly £100,000 in excess of its expenditure. Some of this surplus, we think, might, with advantage, be spent in affording improved facilities for inventors.

It appears to be now generally admitted that the value of patents has been greatly increased by the strict examination to which applications are subjected under the recent Patent Acts.

D

ELECTRICALLY-DRIVEN COTTON MILLS.

[COMMUNICATED.]

When the importance of the cotton trade and the number of cotton mills which exist in this country is taken into consideration, it will be generally conceded that these should be driven on the best principle; the result of a really efficient drive is that money is saved, the productive capacity of the mill is increased, and its output becomes superior in quality.

Notwithstanding the doubts raised by some authorities as to the efficiency of the electric drive, it has for some years been making remarkable progress amongst the cotton mills of Lancashire, a circumstance which proves these doubts to be unjustified, and the following facts and figures in regard to what has been done in the installation of the electric drive in leading mills, and the results obtained in its practical application, support the accuracy of the statement here made.

To apply electricity to mill driving is not one of the easiest matters; it entails a thorough knowledge of spinning, as well as expert electrical and mechanical engineering abilities, but the large number of these installations which have been made of late proves that the problem has been studied, and experiments conducted in such a manner that well-trained electricians can now design installations with a certainty of success.

The textile manufacturer is somewhat reluctant to give data concerning his working costs, and we can hardly be surprised at this; it is significant, however, of the superiority of electric transmission of power over all other methods, that the British Westinghouse Electric and Manufacturing Co., Ltd., a concern which is responsible for many large installations, state that in nearly every case where extensions have been made in mills which they have electrically equipped, electricity has been adopted for the motive power. This concern has, in addition to other mills, installed the electric drive in Messrs. Lister & Co.'s mills at Manningham, Bradford, this installation consisting of a 350-H.P. generator and 350-H.P. motor; Sir Titus Salt's mills, Saltaire, the installation in this case being composed of a combined engine and generator of 500 I.H.P., and a 450-B.H.P. motor, and in Messrs. Joshua Hoyle & Son's cotton mills, at Summerseat, they have installed a 450-H.P. generator and motor.

Messrs. Ashworth, Hadwen & Co., Ltd., were the first cotton spinning and weaving mill-owners in Great Britain to discard mechanical transmission in favour of electricity. The Droylsden Mills, Fairfield, which were the scene of this experiment, contain 88,900 spindles and 900 looms. The electricity both for lighting and power is generated on the premises, and the whole of the steam raising and electric generating plant was designed and fixed by Messrs. Drake and Gorham, Ltd.

The power is applied to the various processes by means of 24 electric motors, aggregating over 1,000 B.H.P. The entire premises are electrically lit, and the whole equipment is carried out on the special system of the engineers.

The new equipment consists of the latest pattern of steam turbine, which although capable of a greater output than the engine which it displaced, covers only 960 sq. ft. of floor surface, and requires an engine room of only 24,000 cb. ft., including the electric generator and switchboard.

The electric drive in these mills, which was installed without stopping the machinery or diminishing the output, has proved most satisfactory, and the installation merits special notice. The arrangement in the blowing room consists of a motor bolted to the ceiling, direct coupled to a high-speed light line shaft running at nearly 600 R.P.M. As each machine is driven direct from this high-speed line shaft, the pulleys and belting are lighter, and the loss in transmission inherent in any mechanical system is materially reduced.

In the preparing room and the corresponding room on the floor above, eight pairs of bevels and 150 ft. of shafting, with 17 bearings, weighing in all 10 tons, have been superseded. The economy in power through this rearrangement may be estimated when it is borne in mind that in an average cotton mill more than 30 per cent. of the total power indicated by the main engine is often required for driving the shafting alone.

In the spinning room the countershaft and main drive have been dispensed with, their place being taken by a motor suspended from the ceiling and connected, in this instance, to the line shaft through ropes, considerable economy in power being obtained.

As regards the winding shed, two motors were installed—one at either end—and by this arrangement 310 ft. of shafting, weighing fully 3 tons, with 50 bearings and six pairs of bevel wheels, were abolished.

The Brush Electrical Engineering Co., Ltd., Loughborough, confirm what has already been said in regard to the efficiency of the electric drive in cotton mills. They have installed the same in some 20 mills in all parts of the world, these comprising over one and a-half million spindles and several thousand looms.

Recent instances of electric driving in cotton mills show that the increased evenness of drive and uniformity of speed obtainable have not only resulted in an improved quality of yarn, but, by reducing the percentage of broken threads, have enabled both driving speeds and output to be materially increased. But the adoption of electric driving brings other incidental advantages and conveniences. The cost of maintenance is less. A shut-down cannot take place which affects more than a small portion of the mill, and vibration is reduced. In the case of new mills, buildings can be lighter in construction. Where a supply of power is available from an outside source, the capital expenditure on power plant is reduced, and the money thereby saved may be usefully spent on productive machinery.

A good example of a modern electrically-driven mill is the Premier Mill, Stalybridge, which is situated in the Tame Valley. This mill is built entirely on the shed principle, there being no upper storeys. The result is that the raw cotton as it passes through the various processes is readily handled until it leaves the mill in the form of finished cloth. Such an arrangement is only possible by the use of the electric drive. There are no heavy drives in the mill, and no floor space whatever is occupied by the driving machinery, the motors being all placed in out-of-the-way but readily accessible positions.

Three-phase current is furnished direct from the Stalybridge, Hyde, Mossley and Dukinfield Joint Board's generating station, and the motors are of the induction type; wherever the conditions permit, a squirrel-cage rotor is employed.

The chief textile installations in Manchester taking power from the public mains are the Butler Street Mills belonging to the Fine Cotton Spinners' Association, Messrs. Bannermann's Brunswick Mills, and Messrs. Andrew and Bramhall's Mill, in Carruthers Street. In each of these mills there is a sub-station for the transformation of the current from the supply pressure to the lower pressure needed at the mill. The Butler Street Mill contains static transformers each of 300 K.V.A. capacity, and totalling 2,000 K.V.A. The transformer plant at the Carruthers Street Mill is of 750 K.V.A. capacity.

The Bolton public mains now supply power for some 230,000 spindles, and, in addition, for about 160 H.P. of auxiliary machinery, doubling frames, warping, reeling and sizing frames used for cotton spinning, and a large amount of power is being supplied for the stretching and starching trades and weaving.

It is not only cotton mills that are changing to electrical driving; many of the Yorkshire woollen mills are now electrically driven. Nearly all these receive their electric supply from the Yorkshire Electric Power Co. About 35 mills are either wholly or partly driven from this company's mains. Amongst others may be named Messrs. F. Doble & Sons, blanket manufacturers, H. Hamer & Sons, woollen manufacturers, R. Swire & Sons, yarn spinners, and Birkhead & Co., shoddy manufacturers, Ravensthorpe; Messrs. Ackroyd & Co., worsted weavers, and E. Wilman and Sons, Silk Mill, Pudsey; Messrs. Cooke, Sons & Co., carpet manufacturers, and Mr. L. Oxley, carpet yarn spinner, Liversedge; the Coloured Yarn Spinning Co., Mirfield; Messrs. Firth, Penny & Co., carpet yarn spinners, and T. Burnley & Sons, worsted fingerings manufacturers, Gomersall; and Messrs. Hepworth & Co., Ossett, shoddy merchants.

The best authorities maintain that as it is reciprocating,

the mill engine cannot give a drive which is perfectly uniform, and that there is always bound to be a certain degree of irregularity, no matter how accurate its design and workmanship may be. Belt and rope drives also, in mechanical power transmission, cause many different irregularities. Changes in the humidity of the atmosphere and the temperature, the stretching of belts and ropes in use, these and other matters all have a tendency to cause the amount of slip in belts and ropes to vary, and the machines can only be run at their highest speed if the drive is, instead of being jerky, absolutely uniform. As it is, the machines are admitted to strain the rove, or yarn, and the very smallest change in the strain makes the finished cloth of irregular texture, and leads to breakages. The system of one motor to each machine gives the manufacturer a drive which is perfectly steady, and a larger production of better class goods is obtained. The speed of a loom in a Yorkshire mill, driven mechanically, was found, when recently tested, to be 84 R.P.M. On its being changed to electric driving the speed was proved to have advanced to 96 R.P.M., the stoppages due to broken ends not being increased. The output of the loom was also increased 24 per cent. This result was owing to the more steady running. Mr. Pearson, a Bury manufacturer, says that having tried steam, gas and electricity, he finds the latter much the best, his machinery turning out more work with less breakages.

In comparative tests of speed variation at Dockring and Leigh Mills, in Yorkshire, the latter, which are electrically driven, showed the smaller speed variation.

Another installation which calls for notice as demonstrating the advantages of the electric drive is the weaving shed of the Heasandford Manufacturing Co., one of the early firms to adopt this drive. This was carried out by Messrs. Mather & Platt, who were among the pioneers in the development of this new drive in Lancashire cotton mills.

In the case of this mill the generating plant consists of a Belliss engine direct-coupled to a three-phase alternator giving a normal output of 550 K.V.A., and a 200-K.V.A. set of similar type. The motors are all of the induction type with squirrel-cage windings.

The same firm have also carried out a number of other important installations, and in one of these the power house contains two generating sets and a pilot set, aggregating 1,700 B.H.P. Motors corresponding to this figure are distributed in the various portions of the mill, which comprises a weaving shed and bleach house, in addition to the spinning room.

The results of careful tests in the various mills equipped by this firm enabled them to state with absolute confidence that an increase of 10 to 20 per cent. in production may be reckoned upon as a result of the change from the mechanical to the electric drive. The higher figure—20 %—has been definitely obtained; but in relation to this, they make the observation that it is only fair to state that the mill in this case was an old one, and the method of driving clumsy and inefficient; even with the best mechanical drive, however, the results in regard to production cannot compete with those which may be obtained by converting to electricity, in their opinion.

The saving in power obtained by means of the electrical drive, their experience proves, is a very variable quantity. In one case they found the power consumption reduced by 40 per cent., but this was an exceptional figure, due to the replacement of antiquated plant by up-to-date plant throughout. It cannot, therefore, be attributed solely to the electrical drive. In fact, in some instances the saving in power is almost negligible, the benefit of the drive being in the more efficient use of the power transmitted, and, consequently, greater production and better quality of material obtained.

This question is a most important one, and often not sufficiently realised. It has been estimated that in a weaving shed an increase of only 2 per cent. in production is sufficient to wipe out the whole coal bill of the mill; in other words, an increase of 100 per cent. in coal consumption would be compensated by an increase of 2 per cent. in the total production of the mill. The same argument applies equally to spinning mills, and the increase in production in the case of spinning mills is in general more noticeable than in the case of weaving sheds, as the steadiness of drive on the spindle itself prevents the bulk of the breakages of yarn which ordinarily occur with the older method of driving.

Mr. C. D. Taite, chief engineer of the Lancashire Electric Power Co., states that, in the case of two similar weaving sheds which came under his notice, one driven by steam and the other by electricity, not only was the output in the latter case increased, and the cost of upkeep lowered, but the cloth produced was of a better quality, and, he adds, where power from an outside source is made use of, capital expenditure is saved and the output of the mill enlarged. This increase, in his opinion, is the most important effect of electric driving. "An increased output of 5 per cent., for example, is equal to an extra yield of 1½ per cent. on the total capital expenditure."

Mr. Woodhouse, chief engineer of the Yorkshire Electric Power Co., mentions a case in his experience where the output of a woollen mill had been increased by 25 per cent. from the same machinery by installing the electric drive, and in another case the extra output obtained balanced the whole of the cost in power.

The removal of shafting and belts admits more light, and does away with the chief cause of dust and dirt, and many silk manufacturers on the Continent consider this in itself a very strong reason why mills in general should be driven electrically.

Other mills in addition to those named, which have adopted electric transmission of power in place of steam with satisfactory results are those of Messrs. Jeremiah Ambler & Sons, Bradford, who have a 350-H.P. generator and 250-H.P. motor; Messrs. G. & J. Stubley, Batley, 600-H.P. generator, 400-H.P. motor; John Crowther, Esq., Brighouse, 130-H.P. engine and generator, 100-H.P. motor; Messrs. J. & M. S. Sharp, Low Moor, 1,200-H.P. engine and generator, 1,000-H.P. of motors; this firm's Greetland branch, Halifax, 200-H.P. generator, 100-H.P. of motors; Washer Lane branch, 200-H.P. generator, 200-H.P. motor; Heckmondwike branch, 200-H.P. of motors; Messrs. John Haigh & Son, Ltd., Huddersfield, 200-H.P. motor and generator; Messrs. Turner Bros., Halifax, 200 H.P.; Messrs. Joshua Crook & Sons, Bolton, 100 H.P.; Peel Mills, Bolton, 200 H.P.; Messrs. T. Ashton, Harrison & Co., Stalybridge, 2,000 H.P.; Aqueduct Mill, Stalybridge, 350 H.P.; Albion Mill, Stalybridge, 1,400 H.P.; Sir J. C. Horsfall, Keighley, 350 H.P. Messrs. Crowther, Sykes & Co., woollen manufacturers, Mirfield; Mr. Smith Feather, commission worsted weaver, Pudsey; Messrs. Fitton & Sons, shoddy manufacturers, Ossett; Messrs. R. Gaunt & Sons, Ltd., worsted spinners, Farsley; Messrs. H. Glover & Co., shoddy manufacturers, Ravensthorpe; Messrs. Hirst & Co., woollen manufacturers, Ravensthorpe; the Leigh Mills Co., Ltd., worsted manufacturers, Stanningley; Messrs. Lund Bros., worsted spinners, Gomersal; Messrs. W. Lupton & Co., Ltd., woollen manufacturers, Pudsey; Messrs. Marshall, Kaye and Marshall, Ltd., woollen manufacturers, Ravensthorpe; Messrs. J. W. & F. N. Priestley, Ltd., woollen mannfacturers, Liversedge; Messrs. E. Slater & Sons, worsted spinners, Stanningley.

Reliability of Electric Train Service.—During the year 1909 there were handled at the Grand Central Station in New York 177,802 trains by means of electric motors, with a total train-minute delay of 36,563. The average detention was only 12 seconds per train—a record said to be unequalled in the history of railroading.—*Electrical World.*

Australia's Manufacturing Aspirations.—The *Australian Mining Standard* has the following:—"Once more the request of the Postmaster-General for tenders for the supply of telephone instruments to be constructed in Australia, has failed to elicit any offer from an actually Australian firm. On this second occasion the time during which tenders would be received was purposely extended, in order to give greater facilities to local manufacturers, who had complained that the notice was too short, but they appear not to be ready to do business even yet. The tenders were to be for 20,000 telephones, and amongst those received there were three for complete instruments, one being from an English firm, which offers to construct the cases in England, of Australian hardwood, or to make the parts in England and assemble them in Australia, alternative prices being quoted; one from a Continental firm, and one from an English firm, which is prepared to construct the instruments in Australia, 'if the necessary arrangements can be made.' No decision has yet been arrived at."

THE ELECTRICAL DRIVING OF TEXTILE MILLS.

By W. B. WOODHOUSE.

The growth of the use of electric power in textile mills during the last few years has kept pace in an interesting way with the development of public supply by the power companies and large corporations. Five years ago electricity was used by a number of textile mills for lighting purposes and for driving odd machines situated in awkward places, but it was not seriously considered as a motive power for the whole mill as to-day is the case. There were a few isolated cases of electrically-driven mills, but the problem had not been seriously discussed, and the needs of the various trades, not to mention the advantages and disadvantages of each method of driving, had hardly been ascertained.

The development of the use of electric power in woollen and worsted mills may for all practical purposes be said to date from the commencement of the Yorkshire Electric Powers Co.'s undertaking, and the first spinning mill to be driven wholly from the public supply was that of Messrs. Thomas Burnley & Sons, Ltd., of Gomersal.

In considering the question of the electrical driving of textile machinery, the writer was led to the conclusion that the advantages to be obtained were so great as to make the question of cost a matter of secondary importance. The improvement in running and the resulting increased output and superior quality were established by tests made, and these advantages, stated generally in a paper read before the Institution of Electrical Engineers in December, 1904, are now becoming generally recognised. Since that date much experience has been gained, and there is being accumulated a mass of information bearing on practice which may be likened to the experience of mill-wrights in mechanical matters, with the important difference that electrical practice is capable of verification at every step by means of the accurate and reliable instruments which are to the engineer's hand.

At the present time the Yorkshire Electric Power Co. sells more energy for driving textile machinery than for any other purpose, and the demand is increasing yearly. There are now being driven from the company's mains some 35 textile mills, of which 16 are using no other source of power. Among the trades so using the supply may be mentioned :—Rag grinders, woollen manufacturers, worsted spinners, woolcombers, weavers, and cotton spinners.

The opponents of electrical driving are naturally many, for its introduction displaces engines, boilers, and much shafting and belting ; those interested in the sale of such articles have been aided by the natural caution with which mill owners regard change of practice of any kind, but each case of conversion lessens the latter, and the rate of its adoption is bound to increase. In discussing the comparative merits of mechanical and electrical driving, comparison is usually made for the case of a new mill ; in such case electrical driving has nothing to fear from the most up-to-date mechanical practice, but it must be remembered that the proportion of new mills to old is so small that the electrical engineer must devote his attention to those existing, if any considerable progress is to be made. In this connection it is interesting to note that of the 16 mills above-mentioned, 12 were formerly driven by mechanical power, and in these cases the millowner has had to set in the balance against electrical driving the cost of the existing steam plant as well as that of the electrical. That the advantages of electrical driving have been great enough to turn the balance is a strong testimony to their value.

Nearly all textile machines are designed to be run at constant speed, and this being so, the use of polyphase motors becomes essential if the best results are to be obtained ; special machines, such as for printing, may require the use of variable speed motors, but these form only a small percentage of the total.

Friction in a textile mill absorbs quite 90 per cent. of the total power required, and of this total the writer has found from a large number of tests that from 30 per cent. to 50 per cent. is absorbed by line shafts, gearing, belts and main drives, the internal friction of the machines being responsible for the rest.

This being so, it is obvious that the driving of each particular machine requires, and will repay, the most careful study. With mechanical driving the effect of variations of temperature, moisture and tension on the power absorbed by belts, ropes and bands, was not measureable by any commercial means ; with electrical driving their effect may be studied continuously and accurately.

Friction losses in shaft bearings and the effect of different lubricants may be studied in the same way, and, apart from the general improvement in mechanical efficiency consequent on a conversion to electrical driving, there is opened a possibility of a still greater reduction in the power taken by machines, by a careful study of the relative merits of different types of bearings, bands, &c.

With such an enormous proportion of power wasted in friction there is a large field for improvement open to the engineer, and who shall say what progress may be made ?

From a Parliamentary return published in 1904 it appears that in Yorkshire alone there were in use some 3,033,333 spindles and 46,045 looms, as well as preparing and finishing machinery.

Approximately the power required to drive this machinery may be taken as 100,000 H.P. Assuming an average cost of coal of 30s. per I.H.P.-year, this represents a sum of £150,000, much of which may and will be saved by the use of electric power.

Many figures have been published of the power required by different classes of machines, but unless detailed particulars are given, such figures may be most misleading. Looms, for example, require from $\frac{1}{3}$ to 1 H.P. each, the current consumption per hour varying from 0·2 unit to 0·6 unit. It therefore behoves one to be careful in obtaining full particulars of the machines before submitting estimates.

The following list of textile users of the Yorkshire Electric Power Co.'s supply will be of interest, as showing the extent of progress already made :—

Textile Users of the Company's Supply.—Dewsbury.—Birkhead & Co., Ravensthorpe ; F. Doble & Sons, Ravensthorpe ; H. Glover & Co., Ravensthorpe ; H. Hamer & Sons, Ravensthorpe ; Hirst & Co., Ltd., Ravensthorpe ; J. Kaye and Co., Mill Street East ; Marshall, Kaye & Marshall, Ltd., Ravensthorpe ; M. Oldroyd & Sons, Ltd., Queen's Mills ; J. Smith & Sons, Ltd., Ravensthorpe ; R. Swire & Sons, Ravensthorpe ; Thornton, Kelley & Co., Earlsheaton ; Wilson Bros., Chickenley Mills.

Farsley.—R. Gaunt & Sons, Ltd., Springfield Mills ; E. Woodhouse & Co., Ltd., Sunny Bank Mills.

Fenay Bridge.—G. Beaumont & Sons, Rowley Mills.

Gomersal.—T. Burnley & Sons, Ltd., Gomersal Mills ; Firth, Penny & Co., Union Mills ; Lund Bros., Gomersal Mills.

Liversedge.—Cooke, Sons & Co., Ltd., Spen Valley Carpet Mill ; L. Oxley, Watergate Mills ; J. W. & F. N. Priestley, Ltd., Victoria Mills.

Mirfield.—Coloured Cotton Spinning Co., Ltd., Britannia Mills ; Kilner Bros., Fold Head Mills.

Ossett.—Bickle Bros., Spring Mills ; Fitton & Sons, Pildacre Mills ; Glover & Ellis, Gedham Mills ; G. Hepworth, Sunnydale Mills.

Pudsey.—Brown, Vickers & Co., South Royd Mills ; S. Feather, Littlemoor Road ; Lumby & Roberts, Victoria Works ; W. Lupton & Co., Ltd., Cliffe Mills ; E. Wilman and Sons, South Park Mills.

Scissett.—E. Blackburn, Ings Dyeworks.

Stanningley.—Leigh Mills Co., Ltd., Leigh Mills ; E. Slater & Sons, Ltd., Perseverance Mills.

Keep Your Attention on Huddersfield. — An American Consul at Huddersfield has reported on the increased demand for electrical goods (motors and supplies) in that district ; and in the course of his report he alludes to an increasing demand in the English market for motors for domestic use, for knife-cleaning, coffee-grinding, meat-mincing, carpet-cleaners, dust-extractors, &c., "but probably the principal demand comes from municipal corporations, which buy large quantities under contracts for a year's supply." American-made electric fans, incandescent lamps, electric meters and light tools are mentioned as being sold here.

VENTILATION AND HUMIDIFYING IN COTTON MILLS.

W. H. BOOTH.

LANCASHIRE'S pre-eminence in cotton spinning is often and properly attributed to climatic conditions. Warmth is necessary to the cotton fibre if it is to spin easily and kindly, and so also is a more or less humid atmosphere. In a factory full of friction-producing machinery this friction has no choice but to appear ultimately in the form of heat, and thus the temperature of the rooms is raised. Warm air will carry very much more moisture per unit volume than will colder air. Air saturated with moisture, as it is when it appears misty, will, if at a low temperature, become quite dry if its temperature be raised some degrees. Dryness is a relative term; it means the potentiality of absorbing moisture. Thus air at 60° may contain the same weight of aqueous vapour per cubic foot as does air at 40°, but the latter may be fully saturated with water and unable to absorb more, whereas the former will have great power of absorption, for, being hot, it is relatively dry or only partially saturated.

Cotton fibre must be warmed in order that it may spin because it contains a waxy constituent which must be softened so that the fibre may lie quietly. The fibre must not be too dry, or it will be curly and will electrify too readily, and not lie flat with other fibres.

The excellence of the Lancashire climate lay for many years in the fact that in spite of the warming of the rooms by friction or by steam pipes, the air was not rendered so very dry as to make coarse spinning difficult. In a dryer climate the addition of more heat to the air reduces it to a condition only to be described by the word parched. The spinning of fine yarns demands a higher temperature than is needed for coarse yarns, and this intensifies the dryness difficulty, and has established even in Lancashire artificial systems of humidification.

If best efficiency is to be obtained from the workman, ventilation must also be attended to. If no workers are present in a room which must be heated and humidified, it is only necessary to circulate the same air by means of a fan through a heater, which may be regulated by means of a thermostat. Once humidified to the proper degree, very little further humidification will be needed, though there is always a loss of air to be supplied by fresh air, which, as it is heated, calls for more moisture. But in work-rooms the air must be changed in order that it may not contain more than nine parts of CO_2 per 10,000, while seven parts per 10,000 would be more satisfactory. In themselves these proportions of CO_2 are of no account, except in so far as they indicate the presence of organic matter derived from the workers who produce the CO_2. It is not the CO_2 that is harmful, but the organic matter that is known to be present if so much CO_2 is present. Thus the humidification is complicated by air change and must be continuous. Whereas at 32°, 1 ft. of air contains just over 2 grains of moisture when saturated, it contains nearly 20 grains at 100°, 11 grains at 90°, and 8 grains at 70° F.

The amount of moisture is dependent solely on the temperature, and in the presence of water the space above that water will always contain a given weight of water vapour dependent upon the temperature of the water. The presence of air does not alter the weight of aqueous vapour, and when saturated air is spoken of it does but mean that the space is as full of water vapour as it can be, the air being present in addition in just such quantity that the joint pressure of the air and of the water vapour are equal to the pressure of the air beyond the influence of the water.

Any space not saturated with water vapour tends to become so by absorption of moisture from bodies present, and under normal conditions of life it is convenient to regard dryness or wetness as attributes of the air, rather than of the space.

Humidification may be carried out variously. One system is to heat air for ventilation to a certain temperature, saturate it at that temperature in a water-spray chest and again heat to the desired temperature so as to dry the air down to the proper degree of humidity. Thus, the final temperature being known, the first temperature is so fixed that the air, if then fully saturated, will become properly humid when it receives its second heating.

In other systems water-spray apparatus is distributed about the rooms and circulates air, constantly adding moisture to maintain the correct humidity. Ventilation in such cases is attended to by fans which expel air at various points, or even by open windows. In such cases humidification is more casual and depends for its distribution upon the general movement of air in the room.

The moisture capacity of space is doubled for each additional 22° F. of temperature, so that it is easy to understand why, in frosty weather, spinning is faulty, for the cold air is dried out extremely when warmed to mill temperature. Where local humidifiers are employed, the heating of rooms is performed by lines of suspended steam piping, and here again the results are more or less casual.

Without expressing an opinion as to the best system of combined ventilation and humidification, the electrical engineer may take things as he finds them, or as selected by the management, and apply electrical driving to any system. Where air propellers are employed to drive air out of a mill they will very often be found fixed in some of the window frames, though, for purposes of light, it would be better to discard this position, and make special openings through the mill walls. Probably this is not done because in English mills there is so much window and so little wall, that the walls would be too much weakened. The fan or propeller faces outwardly, and, if in the side windows of the mill, it is out of the way of being driven by a belt direct from the line shaft if shafting exists. If in an end window, it is beyond the end of the line shaft. In either case, therefore, whether there are or are not shafts, the fan is best driven by its own small direct-connected motor. The number of such fans will be considerable.

With a mill employing 500 people requiring, say, 2,000 cb. ft. of air per person, the total air change will be 1,000,000 cb. ft. per hour, divided between the different rooms according to the number of workers, a ring-spinning room or a room of speed frames employing many more than a room of mule spinning frames. There can be no group driving of these fans. Whatever number may be placed in one room, they are best distributed as much as possible to draw air from every part of the room, in order to maintain the air at an equal quality throughout the whole space. A separate motor for each fan is therefore necessary. In hot weather, fresh air will enter at other, open, windows, and it is this freshly entering air that must be humidified as it is heated in the rooms. In many mills, now, the local humidifiers do not merely circulate air through themselves, just as it may flow to them; they draw fresh air from outside, humidify and warm it, and discharge it into the room to mix with the air in the room, and ultimately to be expelled by the window fans. Unless such special means are taken to let in fresh air, the "vacuum" created by the window fans must be filled casually through chinks, doors, lift openings, and so on, but without ample opening to let air in, the efficiency of a window fan will be reduced. Indeed, it would happen that air would actually enter against the fan, selecting the slower moving fans as openings to supply the demand of the more energetic fans.

In what may be termed the central system of ventilation by means of one or two large fans placed in a basement or in an annexe, there will be no shafting conveniently available in any case, and, again, the natural method will be to employ a motor directly on the fan spindle, or belt coupled. Another electric motor will be employed to circulate the water to the sprays in the humidifier chest or air washer.

Trouble is complained of in regard to the heat generated by the motors of ring frames causing too high a temperature in the work rooms. As to this, the heat generated cannot exceed the amount represented by the loss of efficiency of the motor or the amount by which it falls short of 100 per cent. efficiency. This heat production may be a little more localised than the heat generated by the shafting and belting which the motor replaced. But its amount should not be serious unless it is admitted that a motor is less effective than a mechanical drive. So far, however, as it is, or may be, an inconvenience, it should not be difficult to eliminate by connecting the motor with the outer air and arranging a short flue to draw air through the motor. A ring-frame

motor stands on the floor, and the air ducts need not be in the way, for they can pass through the floor and lie along the ceiling of the room below, and connect through the wall to the outer air. By this means the motor need have no connection with the air in the factory, though it may, when required, be made to draw from outside and deliver inside in the cold weather when warmth is needed.

A very considerable part of the heat required to warm a mill is generated by the machinery. Every pound of coal of, say, 14,000 heat units, is responsible for 1,000 to 1,400 heat units frictionally generated inside the mill, and this heat is welcome enough in winter, when steam must be used, but in the hottest days of summer it could be dispensed with. It always complicates more or less the general question of heating, for the fresh air, which is introduced into the rooms, must not enter fully heated, since it is further heated and "dried" by the machinery friction. It, therefore, enters more humid than is required, but it dries as it falls to the machinery level and acquires heat. This assumes entry of fresh air at the ceilings and its escape at the floor. The tendency will be for the room to be hotter below window level, for not only is the radiation through the windows less, but the machinery heat is almost wholly generated between the level of the bottom of the window and the floor line. But too much weight must not be given to this assumption of stratification, for the movement of the machinery and of the workers must cause considerable air movement, and the hot air near the floor will always tend to mix upwards. To some extent, therefore, downward ventilation, which appears the best system, will be more or less upset by the reverse heat effect of the machinery in those rooms where the machinery is closely spaced and absorbs much power.

It is useful to remember that 25 H.P. of machinery will generate 1,050 B.TH.U. per minute or the equivalent of 1 lb. of water evaporated. The American allowance for summer ventilation of cotton mills varies from 5 per cent. to 10 per cent. of the power required to drive the machinery. In winter only about three-tenths of this power is required to work the heating plant. Thus for a small mill of 10,000 spindles, the ventilating power averages 23 H.P., varying from 11 in winter to 35 in summer, and it is estimated that the output of yarn will be increased 5 per cent. by the all-round better conditions.

In this country probably two-thirds the power will give as satisfactory results, though it is not likely that the output will be so much improved in summer as it may be in America, where, in the south, climatic conditions are bad. In America summer cooling is imperative, owing to the very high temperature. Here a sufficiency of ventilation will rarely fail to produce a reasonable temperature, and in the height of summer special cooling is not required in Lancashire. It must not be assumed that humidification implies that the air in a factory is moistened to an abnormal degree. Americans employ the word conditioning, and in a sense, though a coined word, it does perhaps better describe facts, for the water added to warmed air does little or nothing to increase the relative humidity. It does but bring this up to about a comfortable natural humidity. In frosty weather the fibre of cotton in an unhumidified mill works very badly, simply because cold air holds very little moisture, and it is parched when warmed and the fibres rendered harsh.

Aluminium Production in Italy.—The output of the Società Italiana per la Fabbricazione dell' Alluminio of Rome in 1909 amounted to approximately 750 tons, as compared with 600 tons in the preceding year, although the former quantity is less than the capacity of the furnaces at present in operation. The year's working has closed with a loss of £15,000, as against a loss of £9,200 in 1908. According to the directors' report, the unfavourable results are attributed to the circumstance that the average sale prices were less than in 1908. As, however, the use of aluminium is extending, and the situation of various industries which employ it has improved, a slow but still perceptible recovery in prices has started, and the directors believe that the prospects should be regarded with less concern. One reason for confidence is to be found in the fact that it has been possible for the company to dispose of a larger quantity of the production in the inland market than had been expected.

CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

The Prospects for Engineers in Canada.

In this morning's issue of the *Globe* newspaper of Toronto, there appears the following paragraph:—"In presenting certificates to the students of the Crystal Palace Engineering School, Sir Charles Rivers Wilson said there was room for thousands of competent engineers in Canada."

Sir Charles Rivers Wilson's statement that there is room for thousands of engineers in Canada at the present time is astonishing to those engineers who are living and working in Canada. It may be that Sir Charles did not put his statement quite in the manner given above; but if he did so, it seems to be most misleading, to say the least of it. He states that competent engineers are required; presumably he means all grades of competency, from the young engineer who has just left college to the man who is capable of holding a high position. During the last 18 months engineering in Canada has been booming; but in spite of this boom, it will be found that there are very few engineering vacancies, and that these can be easily filled from engineers already in the country. Although it would not be expected that there would be the hundreds of applications for a vacancy in this country that there would be for a vacancy in England, yet the material to choose from would be ample.

No doubt the result of a statement by such an influential man as Sir Charles Rivers Wilson, who has held one of the foremost positions either in this country or the Old Country, will have the immediate result of sending a number of engineers of all sorts of qualifications out here, expecting at once to drop into comfortable posts. They will certainly be, in the majority of cases, greatly disappointed. If they are of the right sort no doubt they will take their disappointment in the proper manner, and, provided they have the necessary capital, will hang on until they obtain a post of some description, and then work their way up, but they will probably in a large number of cases accept a post in the first instance considerably inferior to the one they have left in England.

This country unquestionably offers better opportunities than the Old Country in engineering, as well as in other lines, but engineers coming here must be prepared to recognise that the conditions here are totally different to those in England. They must recognise that competition, while not so great, is at least great enough to make them proceed with caution. They have to learn the ways of the country, and they must therefore be prepared to accept a lower salary than they have been accustomed to receive until they do learn. Their advancement will depend on themselves, and it will not be of the lightning order. Moreover, men who come here must be prepared to work with their hands if necessary, and those engineers who are not able to support themselves in a machine shop, but are only capable of filling office positions, would be better advised to stop at home. The writer can recall a number of men who came to Canada under the impression that they were going to find a suitable position without any delay, but who have in the end returned to the old country, not merely because they were disappointed in their first expectations, but also because, in many cases, they could not find work to do at all. The fact that they could not find work to do may have been, in some instances, due to their objection to accepting the position of a mechanic in order to make a start, or because they were incapable of doing such work.

As an instance: An engineer arrived in this country in March, 1908. For three months he could obtain no work of any description. Then he obtained a position as night engineer of a small refrigerating plant. In November of the same year this plant shut down, and he found it necessary to find another position. He could not obtain one until the early Spring of 1909, and then he obtained a position as wireman on a construction job. This work was finished in August, 1909, and it was not until January, 1910, that he obtained a position as draughtsman with a manu-

facturing company, which position he holds at the present time, and won't let go if he can help it. This man had four years' apprenticeship in large engineering shops in the North of England; he had a three years' college course, and six years' experience in a well-known power station, leaving there as chief shift engineer, to make his fortune in Canada. This is not a particularly extreme case.

There is, at certain seasons of the year, plenty of scope for mechanics, and a man with a little capital to keep himself for a month or six weeks, provided he comes at the right time of the year, say from January to April, and provided he has the requisite qualifications and is not a man who "can do anything," should be able to obtain work, but even then such men need not expect to have employers waiting around to obtain their services.

This country is the finest country in the world, but gold cannot be picked up on the streets, and men who come here must exercise ordinary common sense as regards their prospects, and take due precautions to see that they shall not be landed in a strange country, without capital enough to enable them to have reasonable time to obtain a post.

Finally, there is work to be obtained for a reasonable number coming at reasonable intervals, but the sweeping statement of Sir Charles Rivers Wilson is productive of more harm than good.

I have had three years' experience of Canada, and I am not one of the dissatisfied ones. Canada has done for me all that I asked her to do, and I cannot say too many good words for her. If Sir Charles had been talking of agriculturists I would say send them, send them by the ship-load, provided they are suitable and have some money, but to try and fill the towns with mechanics, and semi-professional and profes sional men, is little short of criminal. It is reasonable to suppose that Sir Charles has been misreported, but in any case this letter may not come amiss.

As a last word, it is to be remembered that Canada now has several up-to-date and efficient technical schools which yearly pour their graduates broadcast through the country in search of positions, and these men, besides being equally well trained, may have a slight advantage over the Old Country engineers in that they have, even as beginners, a pretty good knowledge of business customs and methods in Canada.

I am quite ready to answer any inquiries with regard to engineering in Canada, as far as I am able.

G. N. Thomas.

Toronto, Canada, *April 13th*, 1910.

Publicity Literature.

The letter from Messrs. W. H. Smith & Sons' Advertising Agency is evidently written with the idea of distracting attention from the real point at issue. I have not abandoned the position originally taken up in my letter, which appeared in your issue dated March 11th. From the commencement I stated that the Publicity Committee of London are charging too much for the literature which they have produced. I repeat that I have an estimate for work similar to the posters, showcard and spring-cleaning folder issued, and the prices work out at: 5s. 3d., 9s. 3d. and 15s., as compared with 25s., 30s. and 20s. charged.

My only reason for drawing attention to the matter is because the Committee state that their scheme is a co-operative one, and if so, then the various undertakings should be able to purchase literature at cost price from the Committee, instead of at the above exorbitant rates.

It is a matter which can easily be investigated by the Committee, if they will take the trouble to obtain competitive prices. I have no quarrel with the printers; in fact, I fail to see that the matter has anything to do with them.

I have, further, pointed out that the Committee have not put forward a comprehensive scheme, which is alone of benefit to the various electric supply undertakings. A circular issued from time to time is a waste of money, and of no value whatever.

Central Station Man.

[This correspondence is now closed.—Eds. E.R.]

The Electrical League.

A few weeks ago an announcement was made of the formation of a new Electrical League, which was to remedy all the troubles existing in the electrical world. Apparently this was on all-fours with a similar association started a few years previously, and one gentleman, who, judging by his *nom de plume*, had been bitten in this, was pertinent enough to ask, through your columns, for a balance-sheet. I have carefully watched for this, but so far without success, if a short note from the secretary, which can only be described as a "get out," be excepted.

I was not "bitten" in the first of what appears to be a series of Leagues, but I, in common with a great many others, will certainly be "shy" of this second attempt, unless light can be thrown on their results.

I realise to the full that something is needed to improve the existing state of affairs, and would support to my utmost any legitimate association that will tend to remedy it. I would suggest, therefore, that the secretary should live up to his self-made reputation as a "Publicity" expert, and make use of some of the methods he has so often advocated to let the profession know what has been, and is to be, done for its advancement.

Anti-League.

India-Rubber Gloves for Extra-High-Pressure.

We have read with interest an article on page 655 of your journal of April 22nd, 1910—viz., the report of the case of the death of Llewellyn Evans—but we cannot understand the answer to the Coroner's question as to india-rubber gloves. The witness here states that an india-rubber glove is no protection against 6,000 volts. As a matter of fact, we are daily making india-rubber gloves and testing them to resist 10,000 volts, and guaranteeing them as having withstood this voltage; and, if required, we should supply gloves tested to 15,000 volts, and even up to 20,000 volts, to meet exceptional cases, if necessary. Therefore, it is surprising to us that the witness should have stated that a rubber glove is no protection against 6,000 volts. Perhaps this letter would be an interesting one to insert in your journal, and may bring replies from electrical experts, which letters would, undoubtedly, be of interest to your readers.

J. G. Ingram & Son.

London, N.E., *April 23rd*, 1910.

Inspection of Coal Mines.

I was much interested in your leader in the current issue of the Electrical Review *re* the above.

You may remember that about a year ago you were good enough to print a letter from me on this very question. I endeavoured to point out that additional inspectors were unnecessary, for the following reasons:—

That there are very few collieries where an electrical inspector does not now, and possibly has done for years, make three or four inspections a year on behalf of one or other of the insurance companies.

Also, that a Government inspector in each district could not hope to make a quarter of this number of inspections yearly of each mine in his district.

That the insurance companies' inspectors are specially trained men and not raw—I borrow your expression—"bounders," whose abilities and tact are inversely proportional to their influence with the "powers that be," at the time of their appointment.

That the competition for the work prevents anything like any attempt at autocracy on the inspector's part.

That these inspections are not paid for by the taxpayer, but by the coal owner, who, in addition to the independent opinion of a man familiar with colliery work on his plant, has the additional benefit of insurance on the plant in the event of a breakdown, for his money.

It will be readily admitted by anyone familiar with the figures, that the insurance companies have faithfully carried out the duties indirectly placed upon them by the Boiler Explosions Act; why, therefore, cannot a similar Act be passed in relation to electrical plant in mines, and so save the taxpayer further burdens and the colliery manager more bother from additional inspectors?

P. A. D.

The Reason Why.

With reference to my communication under the above heading, to which you gave publicity in your issue dated April 15th, I regret to note—and in view of your editorial comment, assume that you share my regret—that the Executive of the Cable-Makers' Association have not replied to the accusations I made.

Since my first communication was sent, I have obtained further information which entirely confirms this accusation. I am informed that three or four Continental concerns have been allotted a quota, *i.e.*, an amount within which they may supply, whereas all the other makers who are members of the German Cable-Makers' Association, which includes several Swiss concerns, obtain a regular payment in consideration of refraining from competition over here.

I respectfully suggest that we are entitled to a statement on the part of the Executive of the Cable-Makers' Association as to the facts of the case, and I hope their statement may convince us that I am incorrectly informed; for the present my accusation holds good, and I will, if necessary, name the various firms who are, and who are not, allowed to compete over here.

In case any objection should be taken to the fact that I am making these communications under a *nom de plume*, I think I may ask the Electrical Review to vouch for my authority and *bona fides*.

Kosmos.

A Plea for Consular Efficiency.

In reference to your article on "British Trade Weakness in Australia" in your issue of April 8th, I regret, after many years' experience in the East, to fully endorse the views expressed therein, particularly in regard to India and Burmah.

It is an undoubted fact that there is an idea abroad, which is daily spreading, partly due, as you state, to the reprehensible folly of certain politicians, but largely due to the lethargy of our manufacturers, that the Britisher is "played out"; and, consequently, he not only has to fight against cheap, shoddy and "dumped" foreign goods, but frequently against a prejudice that is the natural outcome of such an opinion. The manufacturer will naturally ask how he has contributed to this idea and its regrettable resultant prejudice.

In my opinion, and I write after many years of careful study of the subject, it is largely due to the unsuitability of British goods to local markets, and to the lack of any organised system of advertising and for the collection of expert information likely to be of interest to manufacturers.

In the large majority of cases ideas and suggestions for the alteration and improvement of standard British goods to suit local requirements reach manufacturers from individual contractors, merchants or users, and it is not surprising that in many cases they do not receive the careful consideration their importance merits, for such suggestions are made at comparatively rare intervals, and manufacturers have little or no means of forming a correct opinion of their importance. The truth is that the individual manufacturer is not seriously to blame in the matter, it is the fault of our national system.

Other countries, notably America, have "live" Consuls in every country, who, unlike many of ours, are trained technical and commercial men who devote themselves to promoting the trade interests of their country, and to the collection of information likely to be of use to manufacturers. Any manufacturer in America desirous of improving his business relations with a foreign country can obtain, at first hand, exhaustive information from any American Consul upon any subject of interest to him, but such sources of information are for all practical purposes closed to the British manufacturer.

Possibly, at some future date, we may hope to see our own Consular system reorganised upon rational and business lines, but meantime, if British manufacturers wish to dispel the idea that they are "played out," they must help themselves. How is this to be done?

In my opinion it can best be accomplished by an association or group of manufacturers establishing commercial Consulates in all important countries, officered by men who have had years of practical commercial and technical experience in the country to which they are appointed, whose sole business should be, without actually trading, systematically to advertise and push British goods, report upon all foreign imports, the extent to which and the class of people by whom they are used, prices at which they are sold in the local markets, and wherein they differ from British goods.

The establishment of such Consulates (which should be recognised by the home and local Governments) would in itself, to a great extent, be sufficient to dispel the idea that the British manufacturer is "played out," while manufacturers would, with the information compiled by their experts on the spot, be in a position to gauge exactly the requirements of local markets, and there is not the slightest doubt that if they acted upon such information, and endeavoured to meet such requirements, they would soon regain that premier position which is now seriously threatened, if not lost.

W. Donovan.

London, *April 14th*, 1910.

The Need for British Trade Aggression in Turkey.

Referring to Mr. John F. Warren's letter in to-day's Electrical Review under the above heading, I must confess that the sentiments expressed therein not only are very interesting, but also most amusing, especially coming from that quarter, as it seems to be impossible even for Continental makers to accept orders at prices limited by the party in question, much less so for British makers, who are wise enough not to fill the pockets of so-called "concessionaires."

For obvious reasons I sign myself

One Who Knows.

[Our correspondent might more profitably add to this discussion if he went a little more into detail, say, by illustrating his references to limitation of prices.—Eds. E.R.]

Ringing Bells Automatically.

I am exceedingly obliged to you for the courtesy of inserting my query, and I would also thank Mr. Hope-Jones for his remarks and suggestions, which are very much to the point.

Let me, however, hand you the credit for the *nom de plume*—left to my own devices I would have subscribed myself "once bitten twice shy," in view of an experience recently respecting an organ-blowing apparatus—for which a firm of organ builders purposed charging us some 40 per cent. in excess of the makers' list price, and by way of excuse for the attempted extortion babbled the most abject drivel about expert advice and opinion, while, as a matter of fact, all the advice requisite was to be found in your own columns, after reading which I was as well equipped with knowledge upon the subject as these quasi-experts.

Organ blowing, however, is probably a much simpler matter than bell ringing, and it is the very reason quoted by Mr. Hope-Jones that has inspired the rector and churchwardens of a city church to search for ways and means to substitute mechanical for manual ringing; I trust, therefore, that ere long we may have the pleasure of placing instructions with some good firm for the installation of a suitable appliance.

Camp.

London, E.C., *April 26th*, 1910.

Presumably your correspondent "Camp" refers to church bells. Some years ago the rector of Wickford (Essex) experimented with apparatus for ringing his church bells by an electric motor, and, no doubt, he would be willing to give particulars. For ringing school bells and the like electrically, I believe Messrs. John Warner & Sons, Jewin Crescent, Cripplegate, E.C., make special apparatus, which has proved very satisfactory.

W. O. Horsnaill.

Ipswich, *April 20th*, 1910.

Curious Behaviour of Electrical Apparatus.

I should be glad if some of your readers could account for the following, which I may say at present quite baffles me. In an installation recently completed, are 16 flame arc lamps, one of which developed a tendency to jump badly after having burnt for a period varying from half an hour to two hours. The jumping occurs about every ten minutes or so, at times becoming so bad as to cause the arc to go nearly out. Finding the lamp to be in good order, I had one of the other lamps, which had been working satisfactorily in another part of the building, put up in the place of the faulty one, together with its choking coil and transformer, whilst the faulty lamp was hung in the position lately occupied by the other lamp. To my complete surprise the second lamp shows exactly the same symptoms as did its predecessor, whilst the original lamp now burns quite steadily in its new position. I may say that other lamps burning at the same time show no signs of flickering. The arcs are run off the town's three-phase supply, which is reduced by means of a transformer at each lamp to the necessary voltage; all the lighting in the building is divided up so as to balance as nearly as possible.

Vivian B. Learoyd.

Huddersfield, *April 23rd*, 1910.

During the last few months several things have come before my notice, in the ordinary course of business, which I am at a loss to understand, and I am writing in the hope that some of your readers will enlighten me on the subjects.

1. We recently put down a number of single-phase motors (short-circuited rotor type) in a printing works at Tunbridge Wells. One of the machines, a ¾-H.P., ordered to run clockwise, was fixed and connected up. On starting up the machine ran satisfactorily, but when testing for efficiency and horse-power, however, we found that the machine, on being overloaded, gradually came to a standstill, when the rotor immediately started revolving in the opposite direction, and continued to do so until switched out. On again starting up, the machine ran in the right direction, viz., clockwise. The machine has now been working daily for several months, but it will still run in the opposite direction if slightly overloaded.

2. On an installation here a live flexible cord was accidentally cut through with a pair of pliers. To our surprise the fuses (5 amperes) did not blow (although the jaws of the pliers were burnt out); a fuse blew, however, on an entirely different circuit.

3. Only last week, on another job (D.C. supply), a 10-way distributing fuseboard was taken down from a position on the ground floor, the circuit wires cut, and refixed to a new board on the first floor. The work was finished, and tested out satisfactorily. The same evening one of our electricians was called to the house, and found that the flexible cord of one pendant had fused close to the screws in the ceiling rose, and dropped to the ground. Another pendant on another circuit had dropped, the flexible cord having fused about 1 in. above the cord grip of the holder. On looking at a third fitting which was wrong, he found that one cord of the flex only had fused, the fitting hanging from the other. The next evening still another flex fused, but the fitting did not fall, as the cord was knotted in the ceiling rose. I would add that not a single fitting had been touched by our men, and the only alteration made when fixing the new board was the change of the polarity, as we found that, on the old board, the negative pole had been broken through the switches. One of our men informs me that he experienced the same thing in a large provision merchant's shop at Clapham; on this occasion no fewer than seven pendants fell in two days. The polarity of this job was also changed over.

C. J. Bennett.

Tonbridge, *April 23rd*, 1910.

Belgium.—A new company has just been formed in Brussels, with a capital of £40,000 and the title La Société des Etablissements Silicia, to manufacture secondary batteries.

LEGAL.

MAYOR AND COMMONALTY OF THE CITY OF LONDON *v.* COUNTY OF LONDON ELECTRIC SUPPLY CO., LTD.

In this action Mr. Justice Parker in the Chancery Division on Friday last heard a motion by which the plaintiffs sought an interim injunction to restrain the defendants until the trial or further order from breaking up London Bridge for the purpose of laying electric mains.

Mr. Walter, K.C., and Mr. Chubb appeared in support of the motion, and Mr. Balfour Browne, K.C., and Mr. Tydsley Jones for the defendant company.

MR. WALTER, in opening the motion, said that the company purporting to act under powers conferred upon them by the London Electric Supply Act of 1908 were proposing without the consent of the Corporation to break up London Bridge, and that the Corporation as trustees of the Bridge House Trust sought to prevent. The County of London Electric Supply Co. was a company which having certain areas of supply both on the north and the south side of the Thames, and the object of the Act of 1908, as shown by the preamble, was to enable it and certain other companies scheduled to the Act to connect the various areas of supply. The preamble stated the object of the Act to be to enable the companies to connect their undertakings with the undertaking of any other person or company supplying electricity in the County of London. It enabled the undertakers to have a generating station outside the area of supply, and the County Co., in particular, to connect its two areas, north and south of the Thames. In laying the electric mains for that purpose the undertakers were given powers to break up streets within their area of supply. London Bridge was not within any area which the County of London Electric Supply Co. was authorised to supply. They had no powers, therefore, under that section to do what they were proposing to do, for breaking up streets not within any area they were authorised to supply; by a later section of the Act it was provided that they should have power, but, subject to the provisions of the Electric Light Act of 1882. They were entitled to any powers they could get out of the Act of 1882. They had power to lay down electric mains, and in such positions and of such dimensions as might be agreed between the authorised undertakers and the local authority of the district, and, failing agreement, to be settled by an arbitrator to be appointed by the Board of Trade. Under the Act of 1908 for powers with regard to streets not within any area of supply they were referred back to certain sections of the Electric Light Clauses Act of 1899, and the Act of 1882.

MR. JUSTICE PARKER asked whether this company was a special company.

MR. WALTER: No; it is one of the scheduled companies.

MR. BALFOUR BROWNE: Authorised undertakers.

MR WALTER said that was so. The Act of 1899 was a short one, and except so far as any provisional order was concerned it did not apply to the City of London. It did not apply to the City of London except with regard to certain sections, and expressly related to the area in which the undertakers for the time being were authorised to supply energy under their special order. Subject to the provisions of the principal Act and the special order, the undertakers might exercise all the powers conferred upon them by the Act of 1908, and for that purpose might break up such streets as were not repairable by the local authority, and such railways and tramways as they were specially authorised to break up by the special order. London Bridge was not repairable by any local authority. It was repairable by the trustees of the Bridge House Trust, who were the plaintiffs. No part of such repairs were charged in the rates. The defendants could, therefore, break up London Bridge if they were specially authorised to do so by their special order, but the company had no power in any special order to break up London Bridge; London Bridge was not within their area of supply, and was, in fact, unique in that it was not within any area of supply. London Bridge was, in fact, private property, though dedicated to public use. It was expressly provided that nothing in the special order should authorise the undertakers to break up or interfere with any street not repairable by the local authority or any railway or tramway without the consent of the authority, company, or person by whom such street, railway, or tramway was repairable, or of the Board of Trade, or under Sec. 13 of the Act of 1882. That, however, gave the Board of Trade no authority except as regards streets within the area of supply, and therefore the undertakers had to obtain the consent of the plaintiffs, which they had declined to apply for, but which the Corporation were perfectly willing to give, or to obtain special powers. Sec. 12 was the only section which was operative to give powers, Secs. 14 and 15 providing only for the exercise of those powers if and when they were obtained, and it was under these latter sections, or one of them, that the defendants were purporting to act. Sec. 14 provided that where in the exercise of any of the powers under the Act the undertakers proposed to lay any wires or mains in, under, along or across any street or public bridge, and upon giving a month's notice they might appeal to the Board of Trade to approve of any such work. That was not authorising the undertakers to do anything, but merely related to the manner in which it was to be carried out, and then only if such things were in any street or public bridge. Sec. 15 related to streets that were not repairable by a public authority. There was no provision which authorised any work to be carried out by the undertakers under the Act of 1908, and therefore it was necessary for the Court to go back to the Act of 1882. There was nothing in that Act which would authorise or empower the under-

takers to break up any street which was not repairable by local authorities or any railway or tramway without the consent of the company unless in pursuance of special powers conferred by licence or special Act, and a written consent of the Board of Trade did not confer any such special power.

His Lordship asked whether the Act contained any definition of a street.

Mr. Walter said not the Act of 1908, but in the Act of 1882 they found a street described as any street, square, court, alley or thoroughfare within the area within which the undertakers were authorised to supply electricity either by Act or licence of the Board of Trade. London Bridge was in a very curious position. It was the only one bridge in London that was not a public street, and the only one that was not repairable by a local authority. It was, in fact, the private property of the Corporation, and was entirely repairable by them. The defendants, therefore, had no powers in respect of it without the Corporation's consent, or without a special Act. That had been recognised by all other companies. The Corporation were perfectly willing to give any consent upon reasonable terms. On September 14th last year, the defendant company served the Corporation as the local authority with notice that they intended to lay two high-pressure mains across London Bridge, and the Corporation, as the local authority, refused their consent. The company then referred the matter to the Board of Trade, who directed that the Corporation should be served with notice, and the trustees of the Bridge House Estate were, by order of the Board of Trade, subsequently directed to be served with a similar notice, and on the footing of the bridge being a street not repairable by a local authority. The Corporation having refused their consent to the opening of the bridge for the purpose of laying these mains, the company thereupon memorialised the Board of Trade, asking for their consent.

Mr. Justice Parker: Do you say that the only power they have is with regard to streets within their area of supply?

Mr. Walter said he did. The only street in London that was not within some area of supply was London Bridge.

Mr. Justice Parker: And you say that the only powers they have are derived from reference to the previous Acts, and they only apply to a street repairable by a local authority?—Mr. Walter: They have a perfect right to get special powers.

Mr. Justice Parker: You will have to go further, and show that they have no power to break up any street outside their area.—Mr. Walter thought that was so. It was perfectly clear that the Acts referred to streets within the area.

Mr. Justice Parker: Is not the meaning of this Act of 1908 that the scheduled companies can exercise outside their areas the powers that they had within the areas by their previous Acts?—Mr. Walter: But they had not got any powers such as they were now claiming. The powers they had only related to streets repairable by a local authority. London Bridge was excluded from any area of supply, and was the only piece of London that was not in some one's area of supply. It might be that the Act was clumsily framed. If they got special powers they could do it; but they had not, and what was done there must be done either by consent or by special powers. They could get a special provisional order.

Mr. Justice Parker: But by the Act of 1908 they have power to connect their generating station with their area of supply by a line running outside their area. If you are right they cannot connect their two areas at all.

Mr. Walter said that was so, but the difficulty only arose where the road was not repairable by a local authority. Why should these people have power to break up private property? There was no objection by the City to the thing, the real question was whether the company had power to do it without the consent of the Corporation, and in order to keep matters *in statu quo* until the whole matter could be determined he asked for an interim injunction. The company had memorialised the Board of Trade, and the Board of Trade had appointed an arbitrator. The company had no such statutory powers as they claimed in their memorial, the Board of Trade no power to appoint an arbitrator, and, therefore, these proceedings had become necessary. The only people who had power to break up London Bridge were the City of London Electric Lighting Co., who had power under their provisional order.

Mr. Chubb also addressed the Court in support of the motion.

Mr. Balfour Browne, for the defence, said that the powers the company contended for were contained in the Act of 1882. At that time these orders confined these undertakings to particular districts, and the defendant company had got under certain orders districts on the North side and districts on the South side of the Thames. They were confined to those districts, and in them they could break up streets. If London Bridge had been within their area of supply, they had an absolute right to break it up, though, if it was not repairable by the public, the company's powers were limited. Sec. 13 provided that nothing in the Act should authorise the breaking up of any street not repairable by a local authority except with consent or with the dispensation of the Board of Trade. If London Bridge had been within the company's area of supply, not being a street repairable by the public at large, the company would have had to get the consent of the London Bridge authorities or a dispensation from the Board of Trade. By the passing of the Act of 1899, the undertakers, under such superintendence as was thereinafter specified, had power to open and break up all the streets and bridges within the area of their special Act. "Limits of the special Act," he contended, meant any place where they had a right to break up a street, and was not merely limited to a place where they supplied. By those provisions, the company had full power to break up for the purpose of getting from the source of supply to the area of supply. The whole object of the Act of 1908 was to enable the company, amongst other things, to break up streets that were not within their area of supply. This company was used continuously as an illustration of a company that had an area of supply both on the north side and the south side of the Thames, where it would be convenient to couple and link up the two areas. The whole object of the Act was to enable the company, with others, to do that. The object of the Act was to get rid of the disability that the company was under, under the Acts of 1882 and 1899, that they could not do anything outside their area or in the neutral zone lying between their two areas, and to do that the Act authorised the undertakers by means of electric mains to make a connection between two areas which up to that time had been absolutely separated.

His Lordship asked whether a street was defined by that Act.

Mr. Balfour Browne said that it was not, but it was by the Act of 1882, and the powers and provisions of that Act were incorporated in the Act of 1908. Either London Bridge was a street repairable by a local authority, in which case the company had full powers to lay their mains, or if it was not, the approval of the Board of Trade was required, and that had been applied for.

Mr. Tydsley Jones followed on the same side.

Mr. Justice Parker suggested that the construction put upon the Act by Mr. Walter defeated its objects.

Mr. Walter said that the defendants were entitled to apply for a special provisional order. They were under no difficulty if they chose to apply for a provisional order, or if they got consent. It was a question of going over private property. There was a concession with regard to public rights of way, but this was really private property. A local authority had no more rights than he (counsel) had to agree to anything being placed across London Bridge. If the defendants' construction of the Act was right, if any of these electric lighting companies agreed, they could go over any piece of private property, for if they agreed, all the statutory provisions for the protection of private owners disappeared. It could not mean that any Act of Parliament could have given the electric supply companies any such over-riding powers.

His Lordship, in giving judgment, said that the whole question turned upon the true construction of the Act of 1308. That was an Act to confer further powers on certain electric supply companies who were named in the schedule of which the defendants to the action were one. It appeared from the preamble of the Act that the state of affairs which the Act was intended to remedy was that there were in London a number of electric supply companies which had no power to enter into arrangements together, and companies with two and more areas of supply with no powers to make connections between the different areas with a view to securing economy of working. Sec. 11 of the Act provided that the authorised undertakers might enter into agreements, and for the purpose of carrying into effect those agreements, that they might connect their generating stations by electric mains with their areas of supply or with the areas of supply of any of the other scheduled companies, and also by means of electric mains between any two or more areas, or between any such area and any generating station. First of all it was provided that two undertakers being in agreement there might be a connection between them; and, secondly, where a new area was acquired by a company they should have power to make a connection between that area and their generating station. It was obvious that where under the earlier Acts there were separate undertakings there was power under the Act of 1908 for making and maintaining a connection between one undertaking and the other. Where previously the companies had been confined to their particular areas, when they had a power to make agreements, it was obvious that they wanted powers to go outside those areas for the purpose of laying electric mains, and it was to give them those powers that the Act of 1908 was passed. The Legislature had given them powers for certain purposes to break up streets within the districts they were authorised to supply, and by the Act of 1908 those powers were extended to something outside the area—something outside what was originally contemplated. The only way of making sense of the Act was to read it as meaning that the undertakers were to have outside their district the same powers that had already been conferred upon them with regard to streets inside their district. It was provided, however, that nothing in the earlier Acts should authorise the breaking up of any street not governed by a local authority without the consent of the authority, unless in pursuance of special powers, or with the consent of the Board of Trade. It was also provided that the Board of Trade should not give such power until after notice had been given. It appeared to him, therefore, that with regard to streets that were not vested in a local authority, they could only be broken up by agreement, or with the consent of the Board of Trade after the persons affected had been given an opportunity of being heard. It appeared to him, reading the Act as he did, that the Act must be read so as to confer upon the defendants the power to connect their undertaking North and South of the Thames, and for that purpose to break up streets outside either of those areas, and for that purpose they had power to carry their mains across London Bridge. Assuming, as he would do for the purpose of this decision, that London Bridge was not repairable by a local authority, but by the Corporation as trustees of the Bridge House Trust, it came within the limitations of Sec. 13 of the Act of 1882, and Sec. 12 of the Schedule of the Electric Lighting Companies' Act of 1899, and could not be broken up without the consent of the trustees, or the consent of the Board of Trade, obtained in accordance with the section, but the section did authorise the breaking up of the bridge subject to those limitations. To hold otherwise would be to limit the Act in such a way as to make it useless, because no undertaker would have power to break up any street outside his

area. That could not be the object of the Act, which was one to confer powers for the very purpose on the special companies referred to in the schedule. According to the true construction of the Act, therefore, these powers did extend to London Bridge, and he would make a declaration to that effect, leaving the parties to proceed further in the matter or not, as they might be advised. He assumed after that declaration that an injunction would be unnecessary.

Mr. Tydsley Jones said that he understood that it was arranged that the motion should be treated as the trial of the action.

His Lordship said that he would then make a declaration that the defendant company, subject to the provisions of the Act, had power to break up streets outside their area, including London Bridge, whether such bridge was repairable by a local authority or by some persons other than a local authority. The costs of motion would follow the event, unless the parties desired to carry the matter to trial, in which case the costs of the motion would be costs in the action.

Manchester Corporation *v.* Stretford Council.

Mr. Buckmaster, K.C., who has been appointed arbitrator by the Board of Trade, sat at the Westminster Palace Hotel on Saturday to hear arguments in a dispute between the Manchester Corporation and the Stretford District Council regarding the supply of electric current. By an agreement with the various local authorities, the Corporation has control of the entire system of electric tramways in Manchester and the environs, and the district councils which possess electrical undertakings are under contract to supply current to cars running in the area. On Saturday, when the Manchester United football team plays at home, the cars are usually crowded by enthusiasts who wish to see the game, and the Stretford District Council declare that they are not under contract to supply extra current, but only sufficient to meet normal requirements, otherwise they would have to put down additional plant. The question at issue is whether Manchester Corporation or Stretford shall supply the power necessary to carry the Saturday crowds. Mr. Balfour Browne, K.C., appeared for the Corporation, and Mr. M'Morran, K.C., for Stretford. The proceedings were private.

Great Eastern Railway *v.* Leyton U.D.C.

On April 19th before Mr. Justice Phillimore, in the King's Bench Division, on the award of an arbitrator, a point in the above matter was stated in the form of a special case.

The question at issue, says the *Financial News*, was whether, on the conversion of tramways from horse to mechanical traction, involving an increase in the weight of the tramcars, the local authority owning the cars became responsible for any payment in respect of the further repair and strengthening of the structure of bridges over railways, rendered necessary by the additional weight and vibration they had to bear in consequence of the increased weight and speed of the tramcars. The particular question brought forward was that of Lea Bridge, which the Great Eastern Railway Co. had been compelled to strengthen and partly to reconstruct on account as they said, of the conversion of the Urban District Council's tramways from horse to electric traction. Mr. E. Bankes, for the Great Eastern Railway Co., argued that, under Sec. 55 of the Urban District Council's Act of 1904, provision was made for remuneration to the company by the Council if the conversion of the tramways to electric or any other mechanical traction led to increased vibration and strain on the structure of the bridge. Mr. C. A. Russell, for the Urban District Council, contended that the facts disclosed did not bring the case within the section cited.

Mr. Justice Phillimore said the section might have been more clearly expressed, but he was of opinion that the construction contended for by the railway company was right. The reconstruction of the bridge was rendered necessary by the increased weight of mechanically-driven cars. It was possible, he said, that mechanically-driven cars could have been provided of no greater weight than the horse cars, but that would not have been an economical practice, nor in accordance with the custom of this country, which was that mechanically-driven cars, particularly in a district like Leyton, where there was a great number of passengers, should be heavier and give greater accommodation than would be possible with the lighter cars. He, therefore, gave judgment for the railway company, with costs.

The Electrical Co. *v.* Thomas, Son & Co., Ltd.

The hearing of the above action was continued before the Official Referee, Mr. Pollock, during the week.

Technical evidence was called on behalf of the plaintiffs.

Mr. Francis Burdett Johnson said he was employed by the plaintiff company as erector of electrical machinery, and he had had considerable experience in such work. In February, 1906, he went to the Llynvi Valley mine on their behalf. He found that the engine room was in an incomplete state, although parts of the machinery had arrived and were waiting to be installed there. Witness also experienced difficulty in procuring labour. Continuing, witness explained how he erected the electrical plant.

In answer to Counsel, Witness said such electrical machinery was fast revolving machinery, and special oil should be used to lubricate it.

Mr. Sankey, K.C., for plaintiffs: Would common grease be injurious to machinery of this sort running at such a high rate of speed?

Witness replied that the machinery revolved at about 3,000 a minute, and certainly grease would be much too thick as a lubricant. Witness noticed the nature of the oil supplied by the defendants; it was dirty thick oil which they were using on their old steam pump, and was not suitable for electrical machinery at all. Giving evidence as to later occasions when witness visited the colliery after defendants had been running the machinery, witness said that he examined the coils of the motor and found them in a very dirty condition and covered with oil. There was also a "short" on the motor, owing to the fact that the windings had been burnt. The starter had also been broken, and the cable had been brought straight to the motor instead of through the starter.

Mr. Sankey: What was the cause of the short-circuit?

Witness replied that it was due to dirt, oil and dampness. The pump was also not placed at a proper level, and the trolley used for lowering it was not a proper one. The result of the pump being out of level was that the oil from the bearings ran down into the coils of the motor. When witness found this state of things he proceeded to rectify them, and got the motor running by cutting out two of the coils which were burnt. It took him some two or three days to dry the motor out. Owing to the bad state of the brushes he was unable to get the exciter to work. When he had cleaned them and put proper brushes on the motor, however, he experienced no difficulty in getting the exciter to start.

Mr. Abel Thomas: If the exciter worked for a week or ten days satisfactorily, can you give me any reason why it should not go on working properly?

Witness said the only reason he could give was negligence on the part of those who had to look after the machinery. If the engine ran slowly it might prevent the exciter from exciting, but beyond that he could not think of anything which would account for its failure except the negligence to the brushes and commutator, &c. When witness, in company with Mr. Blake, examined the exciter on June 17th, they found it in a very dirty state, but having cleaned it they coupled up the machine in series and in parallel, and on both occasions they made it run satisfactorily. Witness further declared that the sump for the pump was not properly made, and that of itself did not give the electrical machinery a chance of life.

Mr. William Angus Scott, electrical engineer, in business in St. Mary Street, Cardiff, said he had had considerable experience of electrical machinery. He had been an electrical engineer for 18 years and a consulting engineer for four years to the Tredegar Iron and Coal Co. and other collieries. Witness visited the mine and examined the plant. It was quite suitable for the purpose, but sufficient storage or sump room had not been allowed. The conditions under which the plant was working, however, were the worst he had ever seen. The pipes, too, were a poor lot, and so cramped was the room that the exhaust from the steam pump which was working at the time was blowing right on to the motor, and witness certainly would not have liked to be responsible for running the motor afterwards. It was certainly very necessary to have a man in charge of the plant who understood it.

Cross-examined by Mr. Francis Williams for defendants, Witness said it was not necessary for any one to point out to him the defects; they were too obvious.

Mr. Williams: You said the arrangements were the worst you had ever seen?—Yes, for dealing with the propositions such as they had in front of them.

Counsel: They were the worst conditions for working electrical plant; is that what you mean?—No, I mean that the arrangements made for getting the plant to work were the worst I had ever seen.

Cross-examined as to the exhaust, Witness said: The motor was enveloped in steam.

City of Birmingham Tramways Co., Ltd., *v.* Law.

This case was further heard before Mr. Justice A. T. Lawrence in the King's Bench Division, last week, it having been adjourned from the Birmingham Assizes. After hearing counsel for both parties, his Lordship said he would consider his judgment.

Arc Lamp Carbon Prices.—The Highways Committee of the Hackney Borough Council has reported as follows this week:—"We have carefully examined the 11 tenders for yellow flame arc lamp carbons (80,000 pairs) referred to us by the Borough Council on April 7th, 1910. The prices range from £5 15s. to £4 5s. per 1,000 pairs, and it should be mentioned that the highest price in the past has been £3 12s. 6d. per 1,000 pairs. This rise would mean an increase of £50 per annum, or practically 10s. per lamp per annum on the cost of maintaining the flame arc lamps. An attempt appears to have been made to force up the price of flame carbons, and we are of opinion that, for the present, it would be better to give the borough electrical engineer a free hand to buy in the ordinary market from time to time to meet his requirements. We recommend that the tenders for yellow flame arc lamp carbons be not further considered, and that we be empowered for the present to purchase supplies of yellow arc lamp carbons in the ordinary market."

BUSINESS NOTES.

Bankruptcy Proceedings.—M. Henri Francois Louis Pilet, director of the Café Royal, Regent Street, W.—This public examination was held last week at the London Bankruptcy Court, before Mr. Registrar Brougham. The accounts showed total liabilities £30,879, of which £28,700 is expected to rank against assets valued at £658. The debtor, who attributed his failure and insolvency to speculations in various company promotions, stated that he lost £6,000 in attempting, with others, to place on the market a patent menu holder. During 1906 a Mr. H. B. Van Daalen introduced a scheme for the exploitation of the Vedrine Electric Motor Patents, the objects of which were to put on the market an electric motor of sufficient lightness to be applied to an ordinary car, and yet to allow of its being carried 100 miles without being recharged. A syndicate was formed, consisting of himself, Mr. Van Daalen, and two others. Mr. Van Daalen had an option to use the patents in England, and certain other countries. That gentleman had been experimenting with the patents for three or four years, and witness had advanced him £10,000, which was expended on experimental work, and in exploiting the patents in England and France. They had five or six electric cabs constructed at a cost of £700 each, but up to the present time, the electric cab had not been a commercial success. Under the agreement with Mr. Van Daalen, witness was to have from the proceeds of the sale of his interest in the patents to the Electric Vehicles Development Co., £2,500 in cash, and £3,500 in shares. The company, however, went into liquidation in 1908. Subsequently Mr. Van Daalen experimented in a new electric motor, and obtained patents for it. Witness made further advances, and was entitled to one-third share of whatever sum the patents might realise. The £10,000 which witness advanced to Mr. Van Daalen, was borrowed money, and so far he had received no return for the outlay. He had lost a further £3,200 in connection with the opening and carrying on, with two others, of "Paillard's Restaurant," at the Franco-British Exhibition, from May to October, 1908. The examination was concluded.

Richard Bennett Janes, merchant, &c., of 1, Fenchurch Avenue, trading as W. Caudery & Co.—The public examination was held on Wednesday at the London Bankruptcy Court. The accounts disclosed total liabilities £370,875 (unsecured £233,447) and net assets valued at £43,005. In the course of his evidence the debtor stated that the firm's insolvency was attributable to many thousands of pounds having been lost or sunk, mainly at the instigation of his partner, in various businesses and ventures outside their own business, and also to his partner's heavy drawings. They lost £7,000 by financing the General Contract Co., Ltd., which was formed to acquire patents for an electrical switch, and which went into liquidation in 1906. A further £3,000 was lost by investing in shares in the British Uralite Co., Ltd., which was floated to put a fire-proof invention on the market. The examination was concluded.

James William Hunter and Albert Clapham (trading in co-partnership as the Yorkshire Motor-Car and Electrical Engineering Co.), 101, Kirkstall Road, Leeds.—The debtor (Clapham) attended at the County Court House, Albion Place, Leeds, on Tuesday last, before Mr. Registrar Marshall for his adjourned public examination. The liabilities, according to the statement of affairs, were £3,415, with assets estimated to produce £2,047. The Official Receiver stated that the petition was filed by creditors in 1904, Hunter having gone away. The statement of affairs had been prepared to the best of his ability by Clapham. From the report of the trustee it appeared that the assets had realised about £900, which amount had been expended in litigation. There were various complicated questions to inquire into. No dividend whatever had been paid. Clapham was examined shortly after the receiving order, but he did not appear to have known very much about the matter, and the examination was adjourned *sine die*, mainly on account of Hunter's disappearance. Clapham had been working at a weekly wage, and he now had a desire to make an application for his discharge, irrespective of Hunter's appearance. He, therefore, proposed to put a few questions to him and then ask for the examination to be closed as far as he was concerned. In reply to the Official Receiver, Clapham said he was now a power loom tuner. For the last 18 months he had earned only 26s. 3d. a week, but matters were now improving in the trade. He had had very little to do with the partnership business, having been at the same time employed as a manager for his father, who was an electrical engineer. The debtor was persuaded by Hunter to enter into the partnership, in which he thought he was to have a half share. All he obtained from the firm was £2 for two weeks there. The partnership continued about six or seven months, the management of the business being entirely in Hunter's hands. He was unable to give any information whatever about the affairs of the firm. All he had done was to give Hunter at various times a little advice as to motor-cars, of which he had some experience. He had no idea Hunter was going away, and he had never heard a word of him since. He admitted that at the time of the petition he declined to consent to a receiving order, by which a fortnight's time had been lost, but he did this under the advice of his solicitor. He had applied for the examination to be re-opened in order that he might make application for his discharge. The examination was closed.

Henry Kingsford Padwick Barham (trading as the South of England Electrical Engineering Co.), electrical engineer, 60, Fratton Road, Portsmouth, Hants.—The debtor attended at the Court House, Thomas Street, Portsmouth, on Monday last, for his public examination before Mr. Registrar Renny, on a deficiency of £357. Asked how it was he obtained the order on an affidavit setting forth that his whole debts amounted to less than £50, whilst a month later he was in the Court with a deficiency of £350, he said he had not included certain liabilities he had with respect to a patent in regard to which he had taken out patent rights in England, America, Germany, Belgium and France, but the rights had all expired with the exception of America, and there, he had reason to think, the patent had been pirated, and was being worked successfully and profitably by those who had pirated his design. It was an improved electric accumulator, but he had been able to make no money out of it for the want of capital, though he had spent hundreds of pounds upon it. He had had several contracts recently, but none of them had been completed satisfactorily; on all of them he had lost money, and in some instances complaint had been found as to the work done. He admitted that all the work done on these contracts, except that which he had done himself, had been done by premium apprentices, of which he had six, of greater or less experience. Under pressure he admitted that he had acted hardly fairly to these apprentices and their guardians in taking their premiums when he had so few opportunities of properly teaching them their trade. The principal unsecured liabilities upon the statement of affairs were for cash advances by four creditors amounting to £290, but to the extent of £159 this was explained to have been a joint speculation, in respect of which no claim would rank, the advances being made for the purpose of patenting and developing the new type of accumulator before referred to. The examination was closed.

Robert Edward Joy, electrical engineer (Bristol Electrical Co.), Cheltenham Road, Bristol.—A receiving order was made on April 21st, on debtor's own petition.

F. Hastings Medhurst, engineer (deceased).—First meeting, May 4th, at Carey Street, W.C.

Private Meeting.—H. Spreadbury (trading as H. Spreadbury & Co.), cycle maker and electrical engineer, Brent Street, Hendon.—The creditors of the above were called together on April 21st, when a statement of affairs was submitted showing liabilities of £193, all of which were due to unsecured trade creditors. The assets were expected to produce £158, less £27 for preferential claims, leaving net assets of £130. It was stated that the debtor commenced business in November, 1907, with a partner. The joint capital was £100, which was provided in equal proportions. Some little time ago it was agreed that the partnership should be dissolved, and a deed of dissolution was drawn up and signed, whereby the debtor took over the liabilities and assets of the cycle business, while his partner acquired the electrical department. His partner had, however, since discontinued his business. The debtor accordingly obtained possession of the stock which his late partner had left, thinking that he might be called upon to pay the liabilities taken over by his late partner. The liabilities of the latter were said to be in the neighbourhood of £90, while the stock was valued at £37, and there were book debts of some £50. On behalf of the debtor an offer was made of a composition of 4s. in the £. This was not thought to be sufficient, and as one of the creditors would be in a position to levy execution within a few days, it was decided that the debtor should execute a deed of assignment to Mr. G. E. Corfield, accountant, Finsbury Pavement, E.C. A committee of inspection was also appointed, and it was decided that in the meantime the business should be continued with a view of a composition being paid to the creditors.

Japan.—Dairen.—According to the *Board of Trade Journal* the Japanese Minister of Communications stated, at a committee meeting of the Imperial Diet of Japan, that the loan of 40,000,000 yen (£4,083,000) to be floated by the South Manchuria Railway Co. was to be expended as follows:—

	Yen = 2s. 0½d.
Rolling stock on main line	11,400,000
Workshops along main line	3,500,000
Improvements on main line	2,800,000
Reconstruction of Antung-Mukden line	3,000,000
Workshops along Antung-Mukden line	200,000
Electric power house at Dairen	1,000,000
" tramway at Dairen	500,000
" light plant at various places	350,000
Gas plants	350,000
Harbour construction	2,700,000
Equipment for shipping grain	2,000,000
" " coal	2,000,000
Wharf and harbour buildings	1,900,000
Steamers	700,000
Mines	200,000
Public works	3,000,000
Schools, hotels, hospitals, &c.	4,900,000
Total	40,000,000

Electrical Home Trade Improvement.—The following interesting notes appear in the current issue of the *Brush Budget*:—

"There are more electric motors now being made in the Brush works than at any previous moment in the company's history. Electric motors are purchased either for extensions of machinery or for replacing mechanical methods of driving existing machines. In the latter case an order for motors may sometimes merely signify that the purchaser is trying to do his present work at lower cost. But in our own experience most motors are required because more work is to be done. Therefore, we estimate that trade is becoming more active, and that the outlook is more promising, when there are many orders for Brush motors from all parts. The present little boom that we are going on with is caused by home demand, which again is satisfactory."

Book Notices.—*The Art of the British Working Man.*—The May *Strand Magazine* contains a very interesting article under this heading. In the February issue an article on an exhibition of pictures by German workmen was published, and the editor then asked whether English workmen could produce similar work. The result was astonishing, over 400 pictures and sketches being received from men whose occupations would hardly be thought likely to cultivate artistic talents. Nearly a dozen paintings, sketches and poster works are shown, including the reproduction of a delightful painting of a view of the Cappocino, Amalfi, by an assistant electrician named Matthew Mooney, and also a clever pen and ink time sketch by H. Devey, an employé at the P.O. Telegraph factory. We have studied these and the other pictures with the greatest possible pleasure and interest.

"Fire Tests with Doors." "Red Books" of the British Fire Prevention Committee, No. 149. 1910. London: The Offices of the Committee. Price 2s. 6d.

"*Journal* of the Franklin Institute." Vol. CLXIX, No. 4. April, 1910. Philadelphia: The Franklin Institute.

"*Bulletin* of the American Institute of Architects." Vol. X, No. 4. January, 1910. Washington: The Octagon.

The Hill Publishing Co., Ltd, of 6, Bouverie Street, London, E.C., the sole agents in this country for the McGraw-Hill Book Co., of New York, have just issued an April catalogue of technical and scientific books. A summary is given of the contents of a large number of works relating to electricity and engineering subjects.

"*Bulletin* of the Société Belge d'Electriciens." No. XXVII. April, 1910. Brussels: Ramlot Frères et Sœurs.

"Cabbages." By H. J. Wright. London: Agricultural and Horticultural Association. 1d.

Soldering, Brazing and the Joining of Metals. By Thos. Bolas. London: Dawbarn & Ward. Fourth Edition. Price 6d. net.—This is a handy little guide to the useful art above named, which to an electrician is almost the A B C of his craft, and is to anyone a valuable accomplishment. Clear and concise instructions are given, which, with the indispensable aid of practice, should enable the novice to become expert. The book covers a wide range, and can be thoroughly recommended.

Agenda de l'Electro, 1910. Edited by "Electro," Brussels. Price 3·50 *fr.*—This is the third year of the "Agenda," which contains numerous tables and formulæ, besides abundant information of the "pocket-book" order, well up to date, and a diary, making a neat and handy little publication.

Record of Sports.—The Royal Insurance Co., Ltd., Liverpool, has issued the seventh edition of this little book, which it is claimed is the most reliable and complete work of its kind in existence. Copies may be had on application to the company, until the stock is exhausted.

Name, please!—In an American Consular document we read:—"An American Consular officer in a European country reports that during the past year a local municipality installed a public telephone system, the same having a capacity of 600 instruments. The city now intends to extend the central station and the overhead and underground wiring, in order to increase the capacity to 1,200 instruments, and the contract will amount to about $25,000 to $30,000. The City Council is not very well satisfied with the working of the present European system, and desires to become acquainted with the latest American systems, and with that end in view requested to be placed in touch with manufacturers in the United States. The Council is desirous of receiving not only catalogues and price lists, but also all possible detailed information and specifications. When forwarding the above information it would be well to address one set to the Mayor of the city in question and a duplicate to the Consulate transmitting the report. Correspondence may be in English."

Trade Announcements.—The Union Cable Co., Ltd., announce that, by mutual agreement, Messrs. James T. Donald and Co., Ltd., 35, McAlpine Street, Glasgow, have relinquished their Scottish representation in favour of Messrs. J. C. Fisher & Co., Mr. J. C. Fisher, who has had the management of Messrs. J. T. Donald & Co.'s electrical department for the past seven years, having now opened offices at York Buildings, York Street, Glasgow. A stock of the usual sizes of electric wires and cables will be carried.

Messrs Tetley & Co., of Manchester, have appointed Mr. Harold J. Jervis, "Inglefield," Oakley Drive, Muirend, Glasgow, as their sole representative for Scotland.

Catalogues and Lists.—The Witton-Kramer Electric Tool and Hoist Co., Witton, Birmingham.—Several new leaflets have been issued showing a number of illustrations of their Witton-Kramer electric lifting magnets; electric trolley hoisting appliances, winches and travelling cranes; and portable tool (drilling and grinding) equipments. A complete catalogue of these specialities is in course of preparation for early publication.

Openings in New Zealand.—H.M. Trade Commissioner for New Zealand (Mr. G. H. F. Rolleston) reports that a Wellington firm desires to obtain quotations from British manufacturers for solid drawn steel conduit and fittings, screwed with standard gas thread; also for insulated cable of the make of the Associated Makers or equal thereto. Manufacturers interested should send catalogues, with the latest discounts and trade terms, quoting preferably c.i.f. and e. Mr. Rolleston also reports that another Wellington firm wish to get into touch with manufacturers of electric cable of all descriptions. Communications regarding the above should be addressed to H.M. Trade Commissioner, 9, Grey Street, Wellington.—*Board of Trade Journal.*

Mr. Chas. E. Miller, Reade Street, New York.—Annual catalogue (No. 16) giving fully illustrated particulars and prices of a wide range of parts, fittings and sundries, for motor-car, motor-boat and motor-cycle purposes.

Messrs. J. C. Lyell & Co., Ltd., 55, Victoria Street, London, S.W.—Illustrated and priced leaflet briefly describing the "Clair" combined electric bench, lathe or hand drilling and grinding machine.

Messrs. Siemens Bros. Dynamo Works, Ltd., Caxton House, Westminster, S.W.—Three new price lists, all fully illustrated and neatly arranged. One of 32 pages relates to a variety of installation accessories, a second (20 pages) deals with conduits and fittings, and the third describes the "Zed" fuse system. All of the manufactures set forth in these lists are available in stock.

The British Aluminium Co., Ltd., 109, Queen Victoria Street, London, E.C.—Leaflet No. 104, giving a few figures of extras above basis price for 14 to 30 S.W.G. aluminium wire and strand.

Messrs. Isenthal & Co., 85, Mortimer Street, London, W.—Pamphlet describing their new aperiodic millivolt and amperemeter for continuous and alternating current.

The Braulik Engineering Co., 8, Lambeth Hill, London, E.C.—New lists, No. 1 showing and tabulating very full particulars and prices of "Eclipse" direct-current dynamos and motors of new design; and No. 2 dealing in similar manner with motor starters, regulators and controllers.

Messrs. T. W. Broadbent, Ltd., Victoria Electrical Works, Huddersfield.—Progress paper No. 2, describing the firm's D type generators, and M type protected motors. Messrs. Broadbent report the continuation of very satisfactory trade, as a list of orders booked this year for machines and switchboards and starters now before us fully testifies.

The A.E.G. Electric Co., Ltd., 121-125, Charing Cross Road, London, W.C.—32-page publication finely and fully illustrated with half-tones and diagrams, and containing descriptive matter relating to the A.E.G. steam turbo-dynamos, which we learn are now made from 2 kw. up to 15,000 kw., machines of both these sizes being in actual operation.

Electrical Apparatus Co., Ltd., Milford Works, Queen's Road, Battersea, S.W.—Leaflet F, describing the Koolark enclosed fuses, now made to stock in all sizes; and leaflet L, relating to a new current limiter.

Liquidations.—The Grasse and Cannes Electric Tramways Syndicate, Ltd.—This company is winding up voluntarily, with Mr. H. R. Green, 37, Conduit Street, W., as liquidator. A meeting of creditors is called for May 3rd.

The Accumulator and Motor Construction Co., Ltd.—A meeting is to be held at 79, Queen Street, E.C., on May 31st, to hear an account of the winding-up from the liquidator, Mr. Jesse Smith.

The Moore Light.—The Gesellschaft fur Elektrische Industrie (Moore Licht), has been formed in Berlin with a paid-up capital of £60,000, for the working of the Moore light patents in all countries in Europe. The system has already been introduced in the United States, where installations on a large scale are being carried out, and experimental installations which have been, it is reported, undertaken in Berlin, Moscow, London and Bradford, have yielded satisfactory results.

LIGHTING and POWER NOTES.

Brazil.—The *Diario Official* of March 19th publishes a decree granting to the Companhia Brazileira de Energia Electrica a concession for utilising the waters of the river Paraguassu (State of Bahia) for the development of electric power.—*Board of Trade Journal.*

China.—The *Japan Weekly Mail* reports that the electric lighting enterprise in the town of Changchun has been temporarily abandoned by its Chinese projectors, owing to the want of funds.

Church.—The B. of T. has issued a prov. order with a view to the same being included in a confirmation Bill about to be introduced into Parliament authorising the Council to supply electrical energy within the urban district.

Continental Notes.—Russia.—The following information is from the report by the British Vice-Consul at Baku (Mr. A. E. R. McDonell) on the trade of that district in 1909, which will shortly be issued: The town of Baku having raised a loan of some 27 million roubles, certain sums have been set apart for the following works: The bringing of fresh water to the town; the building of an electric power station and the lighting of the town by electricity; the building of town slaughter-houses; the electrification of the tramways; the sewerage and drainage of the town. The pumps required for the work will have to be imported, as Russia cannot supply them. All tenders should be made by people acquainted with the locality and the conditions of the surrounding country. British firms interested would do well to send out their

representatives immediately. With regard to electric lighting and the electrification of tramways, it is intended to light the town with electricity, for which purpose 960 arc lamps will be required. At the time of writing, nothing definite had been settled as to whether the town shall build its own power station or come to some arrangement with the existing power company. The electrification of the tramways is also unsettled, as it depends upon what arrangement is arrived at as regards the power station. Particulars of the route, gradient and number of miles of line may be obtained by British firms on application to the Commercial Intelligence Branch of the Board of Trade, 73, Basinghall Street, London, E.C.—*Board of Trade Journal.*

Germany.—A scheme is receiving consideration with a view to the utilisation of the water-power of the lower Lech where that river discharges into the Danube, and where it is proposed to erect a hydro-electric station of from 12,000 to 18,000 H.P. It was originally intended to build four stations on this section of the river, the first of which was to be associated with the existing station belonging to the Lech Electricity Works Co., of Augsburg, but this project has been abandoned. This company, which is connected with the Lahmeyer group, has 8,500 H.P. at disposal, and furnishes current to Augsburg and the vicinity. The new scheme is proposed to afford a supply to the towns of Nuremberg and Furth by means of a transmission line of 62 miles, and the Schuckert Co. is associated with the syndicate which is engaged on the consideration of the problem. The preliminary investigations and examination of the plans will determine whether the promoters are prepared to undertake their part, whilst on the other hand, the possible position which may be assumed by the Bavarian Government is also of importance, inasmuch as the interests of the existing Lech electricity works will have to be safeguarded. It is not expected that a decision will be arrived at before the end of this year. Other schemes of a more or less extensive character are also under consideration in other districts, one of which contemplates the establishment of large works in the neighbourhood of the lignite deposits at Halle and the transmission of power to the German capital.

Spain.—Owing to technical difficulties not foreseen the Hidro-electrica de Catalana, a company formed by Don Horacio Echavarrieta, to supply electric current to Barcelona from waterfalls in the province of Gerona, has been dissolved.

Austria.—The Municipal Council of Villach is carrying out a large electric undertaking, which is to cost 3,300,000 kr. The water of the river Gail is to be impounded near Arnoldstein by a weir. The generating equipment will consist of three 2,000 H.P. double Francis turbines (eventually to be increased to four) directly-coupled to three 1,700-KW. dynamos. An 18-kilometre transmission line, with a terminal pressure of 15,000 volts, will carry the current to the works of the Kellner-Partington Paper Pulp Co., at St. Magdalena, and also to Villach, the sub-station at the latter place being equipped with a 5,000-volt transformer, which will supply some 50 sub-transformer stations. Both the high and low-tension distribution lines are to be laid underground.

East Africa.—It is announced that the Governor of German East Africa has granted to Hans F. A. Zieseniss, of Frankfort-on-the-Main, a provisional concession for the establishment of hydro-electric plant for the industrial utilisation of the Pangani Falls. It is proposed, in the first place, to install plant of 30,000 H.P., which would subsequently be increased to from 70,000 H.P. to 80,000 H.P., and the power is to be used for the fixation of atmospheric nitrogen. The scheme is to be carried through by a company to be formed specially for the purpose, with a share capital of from £300,000 to £350,000.

Glasgow.—The new rules in connection with the electricity supply of the Glasgow T.C. are announced to come into force on May 1st.

Grimsby.—The T.C. has decided to adopt a scheme for supplying arc lamps for the exterior lighting of business premises on the hire-purchase system, or by simple rental.

Hindley.—The South Lancashire Tramway Co. has applied to the U.D.C. for permission to supply electricity to Messrs. Crompton & Shawcross for a period of five years.

Honduras.—A concession has lately been granted for the establishment and working during a period of 20 years of a central electric lighting and power station at Puerto Corbe. A concession has also been granted for the erection of a similar plant at San Pedro Sula.

Leicester.—The Tramways Committee has recommended the T.C. to apply for a loan of £19,190 for the installation at the power station of a 1,000-H.P. turbo-generator, two new boilers, condensing plant and a feed pump, and the enlargement of the engine house.

The T.C. is also recommended to reduce the basic charge for power supply from 15s. per H.P. to 10s., the price of energy to remain at ¾d. per unit. An extended scale of discounts is also recommended.

London.—Hackney.—The Electricity Committee reports having examined 11 tenders for 80,000 yellow flame arc lamp carbons, and the prices ranged from £5 15s. to £4 5s. per 1,000 pairs. The highest price in the past has been £3 12s. 6d. per 1,000 pairs. The Committee go on to say that an attempt appears to have been made to force up the price of flame carbons, and that it has, therefore, decided for the present to buy in the ordinary market from time to time to meet requirements. A communication has been received from the L.C.C. in reference to the question of the period of electricity loans. The County Council notes that the B.C. has been able to set aside a reserve fund, of which the balance at March 31st last was £16,873, and observes that the B.C. is repaying about 75 per cent. of its electricity loans on the system of equal instalments of principal, whereby the charge for interest diminishes each year, and it would, therefore, seem probable that the B.C. would be able to transfer larger sums to reserve fund in the future than it has done in the past. It is suggested that the B.C. would be well advised, as an alternative to accumulating so large a reserve fund, to take steps to reduce the period of the loans now running for 42 years to periods equivalent to the terms now allowed, had such periods been in operation since the commencement of the Borough Council's undertaking. The maximum terms of repayment now sanctioned in respect of electricity undertakings are: Buildings, 50 years; mains, 30 years; plant and machinery, 20 years; house services, 12 years; meters, 10 years. The L.C.C., therefore, suggests that the B.C. would do well to consider, as a first step in this direction, whether it can arrange for the reduction of the period of loans sanctioned for plant and machinery for 42 years. The Finance Committee of the B.C. is of opinion that it would be inadvisable to reopen the question of loans, and the L.C.C. is to be so informed.

Hampstead.—At the last meeting of the B.C. the Lighting Committee reported having considered a report of Sir Alexander Kennedy on the financial and technical aspects of the undertaking. The Committee was unanimously of opinion that the scheme recommended by him should be carried out. At present it recommended that some of the existing plant be disposed of, and that new plant be installed at an estimated cost of £8,515. It was stated that Sir A. W. Kennedy's report agreed with that of Mr. G. H. Cottam, the borough electrical engineer. The total expenditure would be £18,000, and an annual saving would be effected of £4,000. The money required would be borrowed from the reserve fund, which now amounted to £45,000. The recommendation was adopted, and subsequently a number of tenders for the supply of the new plant were received and referred to the Lighting Committee. The Lighting Committee has had under consideration an amended offer from the Gas Light and Coke Co. for the improvement of the lighting of the street lamps. A motion that the work of converting the gas lamps into electric lamps, as already decided upon, be deferred until the amended offer is considered, was negatived.

Battersea.—Ten 200-C.P. metallic-filament lamps are to be provided and fixed for lighting Clapham Common, West Side, at an estimated cost of £40.

Marylebone.—The Electricity Committee, in submitting the annual estimates, reports that as far as can at present be ascertained the total sales to private consumers for the year ended March 31st last will amount to 10,316,000 units and the average price to 3·63d. (including meter rents). The units show an increase of 16 per cent. over the previous year, and the average price a reduction of 9 per cent. For the new year the increase in units has been put at half last year's increase, viz., 8 per cent., and there will probably be a further diminution of prices to the extent of ·28d. per unit, or 8 per cent. This gives an estimated increase of 825,000 units compared with nearly 1,500,000, the increase of sales to private consumers during the past year. A substantial increase in the figures under public lighting naturally follows the adoption during the past year of the three schemes for converting to electricity the whole of the gas lamps in the borough. It is anticipated that the last scheme will be actively put in hand towards the end of next month. It is calculated that the increased units for street lighting purposes will amount to 440,000 over last year. In estimating the cost of generation, distribution, management, &c., the balance costs for the half-hear to December last have been taken as a basis, and it has been assumed that all additional sales during the year will not exceed a total cost of ·5d. per unit. This very conservative method of estimating has proved during the past year to be excessive. Taking the equivalent of last year's total sales at actual cost, and all additional estimated sales at ·5d., gives an average cost of ·868d. per unit on estimated sales. The general manager is of opinion that the sales department will pay its way after debiting all expenditure properly chargeable against it. Finally, the report says that after reducing the capital liabilities by £37,915, it is estimated that there will be a surplus on the year's working of £8,602.

In order to facilitate explanation of the "maximum-demand" and "telephone" systems of charging, the general manager, Mr. Seabrook, has had a neat little booklet prepared, in which the main features of the two systems are explained in the simplest possible terms. Looking at this from the uninitiated consumer's point of view, while we admire the courage and ingenuity with which the maximum-demand system is attacked, we fear that this hitherto insoluble puzzle will still severely tax the brains of the inquiring customer; but the "telephone" system offers a sharp contrast, presenting no difficulties, but offering tempting inducements such as "all units are at 1d.," and "waste . . . . becomes a matter of no importance." We understand that since the "telephone" system was introduced last year, no less than £7,000 has been received in annual charges, *payable in advance.*

Fulham.—Experiments have recently been made with a new type of bracket lantern and grouped metallic filament lamps which offer a very satisfactory and economical improvement upon the existing system of public lighting. It has, therefore, been decided that the whole of the lamps in one district shall be similarly fitted.

Lewisham.—The B.C. is to invite tenders from the South Metropolitan Electric Light Co., and the South Metropolitan Gas Co., for lighting the first-class hall at Ladywell Baths.

Manchester.—The Electricity Committee, on the 20th inst., decided to give £12,000 to the relief of the rates, the contribution being the same as last year's. The profits for the year were £55,220.

Oldham.—An interesting situation was created by a case at Oldham on the 20th inst., in which the Health Committee summoned the Corporation for creating a nuisance by the excessive emission of black smoke at their electricity works. The deputy town clerk, who prosecuted on behalf of the Health Committee, said the electrical engineer (Mr. Newington) felt somewhat diffident in offering his defence inasmuch as the magistrates were burgesses, and therefore among those summoned as defendants. Mr. Newington said the Corporation was making experiments at the electricity works with a view to doing away with the smoke nuisance, and thought it would be successful. This would cost about £2,500. The chairman (Dr. Yates) remarked that the high mortality in Oldham was caused largely by bronchial and pulmonary complaints, which were due in great measure to the pollution of the atmosphere by black smoke. The Corporation was fined 20s. and costs in each of two cases.

Rawtenstall.—The report of the electricity department for the period ending March 31st (10 months) shows a gross profit of £1,450, which is converted to a loss of £438 on account of interest and sinking fund charges amounting to £1,889. The units sold for lighting were 34,988; for power, 30,008; tramways, 414,904. The average price per unit for lighting was 3·44d.; for power, 1·15d.; for street lighting, 2·25d.; for tramways, 1·50d.; and for all purposes, 1·64d. The works cost per unit amounted to ·79d.; total, 1·00d. Negotiations have been completed with the Bacup Corporation for a supply to the latter of electricity in bulk.

Runcorn.—The R.D.C. has decided to offer no objection to the application of the Salt Union, Ltd., for a prov. order for E.L., provided a portion of Main Street, Frodsham, is included in the compulsory area of supply.

Stanley (Yorks).—The Yorkshire Electric Power Co. has applied to the U.D.C. for its consent to supply energy to Wrenthorpe colliery.

Transvaal.—A Bill has been published to provide for the licensing of persons carrying on undertakings for the production and supply of power, provision being made for the appointment of a power undertaking board, to which applications for licences shall be referred.

Watford.—The Council has approved terms submitted by the electrical engineer for supplying energy to the London and North-Western Railway Co., subject to an agreement being entered into providing for a minimum payment of £500 per annum for seven years.

West Ham.—During the forthcoming summer a wing is to be added to the Greengate Street car depôt. The electrical engineer reports in regard to the additional plant required for the electricity undertaking, that it will be necessary to put in hand some of the work as soon at possible. The turbo-alternator is under discussion with the Westinghouse Co., and the engineer suggested that tenders be obtained for the condensing plant to be used in conjunction therewith. It is advisable to proceed with the boiler and switchgear at an early date. The cables for the Stratford and Silvertown schemes are included in the existing contract with the B.I. and H. Cables, Ltd., and he suggested that these be put in hand as soon as convenient. The Committee has instructed the engineer to obtain quotations from a number of firms for the plant mentioned by him, and it has also approved his proposal to utilise the land in Chapel Street for the purpose of a sub-station. On the subject of the supply to the Port of London Authority, the Woolwich B.C. is prepared to give consent to West Ham supplying the Port Authority with electricity for use in that portion of the docks in Woolwich upon payment to Woolwich of £50 per annum, and upon the condition that the authority agrees not to assess the Woolwich Council's cables passing under the river by means of the proposed subway or otherwise in the event of its deciding hereafter to supply North Woolwich from the south side of the river, or at the most to charge a nominal rent only, and upon the further condition that West Ham agrees, if called upon, to give Woolwich a supply in bulk at prices set out. West Ham is unable to agree to these terms, and is to repeat the former offer to Woolwich. In the meantime the electrical engineer is to continue his negotiations with the Port of London Authority as to taking a supply for distribution to consumers within the dock area.

Whitwood.—The U.D.C. has signed an agreement with the Power Company for a supply of electricity. The Council is to have the option of determining the agreement at the end of 21 years.

TRAMWAY and RAILWAY NOTES.

Birmingham.—The Tramways Committee recommends that a tramway should be constructed from Five Ways, Edgbaston, along the Hagley Road to the King's Head, Harborne. This route is about 2¼ miles in length. At the King's Head it is proposed to construct the line which was the subject of negotiations between the Birmingham Tramways Committee, Oldbury and Smethwick, to the corner of Balden Road, Beach Lanes, which would link it up with the suburb of Quinton. The scheme will involve application for Parliamentary powers, which, in the event of the City Council approving, will be sought in the session of 1911.

Blackpool.—At South Shore, Blackpool, tramway improvements are to be carried out by means of loop lines near the Victoria Pier, to cope with the abnormal traffic which occurs in that district at certain periods of the day in the season. The requirements of the residents will be met by a loop line being placed to the north of the Victoria Pier with a shelter on the island footpath. It is proposed to make an extension of nearly 40 ft. southwards, on which will be four lines, enabling four cars to load up at once, and a large shelter to accommodate 300 to 400 people, is suggested to be built on this extension. A sub-committee has been appointed to consider the scheme, and report.

Thanks to the aviation week and two Easters falling in the financial year, the receipts on the Blackpool tramways during the past year amounted to £58,701, which constituted a record, and there was a profit balance for disposal of £9,432. The electricity department had an income for the year of £34,782, and a profit balance of about £6,500.

Brazil.—The British Acting Consul-General at Rio de Janeiro reports that the necessary authorisation has been given for the electrification of the northern line of the Leopoldina Railway for the purpose of establishing a suburban service between Rio and Petropolis.—*Board of Trade Journal.*

Chile.—According to Reuter, the Chilian Government will in May ask for tenders for the electrification of the railway from Santiago to Valparaiso and its branches, the total length of line being 250 kilometres (156 miles). The electrification will be continued on the remainder of the Chilian railways.

Continental Notes.—Austria.—A group of interested persons, including the president of the local Foreign Traffic Association, King's Counsel Bazzani, have in hand a scheme to build a railway to the hill health-resort at Molveno. The line will start from Mezzolombardo, and be continued by a cable railway 600 m. upwards, whence it will be carried by an electric adhesion line as far as Fai, the rest of the course to Molveno being negotiated by a motor-'bus service.

Official permission has been granted for the preliminary surveys for an electric normal gauge railway to run from Witkowitz-Klein Hrabowa-Gross Hrabowa, with a branch to Neu Biela. Herr Ignaz Goldberger, of Zahreb on the Oder, is the interested party.

Russia.—A proposal to adopt electric traction on the horse tramways in the town of Kharkoff is at present under consideration.

Dowlais.—Owing to the great overcrowding of the electric cars at Dowlais, it has been decided to put on more double-decked cars in the Merthyr district. The Council has also completed the Cefn Bridge, and it is proposed to extend the tramway lines without delay. In the very near future there will be considerable electrical developments in the district.

Exeter.—Mr H. C. Bartlett, manager of the tramways, in his statement for the year ending March 31st, presented to the City Council, observes that the total receipts for the year are £16,929, being £1,056 in excess of the previous 12 months.

Glasgow.—At a meeting of the Works Committee of the T.C. it was decided to recommend that the income-tax charged to the department, amounting to £17,490, be paid. It was also decided to recommend that £25,000 be paid at Whit Sunday next to the Common Good, to account of the surplus which may accrue from the undertaking for the year to May 31st next.

Heywood.—It was reported at a meeting of the T.C. on Wednesday, April 20th, that the loss on the working of the tramways for the past year amounted to £1,187, as against a loss of £1,202 on the previous 12 months. On the electricity department there was a profit of £124, as compared with a loss a year ago of £88.

Japan.—According to the last Japanese mail, the committee appointed by the municipal authorities of Tokio to consider and report on the application for permission to construct and work an overhead electric railway in the city, is in favour of the scheme being made a municipal enterprise.

The town section of the Kobe electric railway was opened for traffic on the 5th inst.

Milnrow.—The U.D.C. proposes to ask for Parliamentary powers to construct and work tramways extending from the present Milnrow Road terminus of the Rochdale system to the end of Huddersfield Road, Newhey.

Rawtenstall.—The report for the financial year just ended shows that 2,146,322 passengers have been carried on the Corporation's electric tramways, and the cars have run 308,085 miles. The gross capital expenditure was £142,066; revenue, (steam) £1,025, (electric) £14,479; working expenses, £9,372; sinking fund, £3,025; interest on loans, £3,434. Loss (taken from account of reserve or provided for in last year's estimates), £1,127; the average revenue per c.m. was 11·2d. The total capital expenditure on tramways and electricity undertakings amounts to £180,943. On the Bacup tramways the capital expenditure amounts to £19,276.

Smethwick.—The T.C. has received no satisfactory reply from the Tramway Co. in regard to its representations upon the revised fares, and has accordingly instructed the town clerk to ask the company to appoint an arbitrator under the terms of the agreement.

U.S.A.—The International Elevated Railroad Co., of Washington, D.C., has been incorporated with a capital of 10 millions sterling, and the Universal Motor Co., with a capital of one million, for the purpose of building a mono-rail line through the city of Brooklyn, after the style of the Behr railway.—*Electrical World.*

According to *Electric Traction Weekly*, the New York, New Haven and Hartford Railway is contemplating an expenditure of $3,000,000 on a tunnel at Fall River, and on the double tracking and electrification of the line between Providence, New Bedford and Fall River.

The three weeks' test of the Edison storage battery car on a cross town route in New York has resulted in 16 similar cars being ordered. The car took 853 watt-hours per mile, being the equivalent of 14 cross town trips a day at 4·3 mills a running mile, or less than 30 cents per day.

TELEGRAPH and TELEPHONE NOTES.

East African Protectorate.—The annual report of the East African Protectorate by the Governor, submitted to the Colonial Office, states that the total mileage of telegraphs in the Protectorate is 2,234, excluding telephone lines. General telephone systems were, during the past year, introduced in Nairobi and Mombasa, and a considerable number of private subscribers have been connected. The telephone mileage in the Protectorate is 145.

Hawaii.—Experiments are being made by the Japanese Government in connection with the establishment of a wireless telegraph service between Japan and Hawaii.

Telephotography.—Mr. T. T. Baker last week lectured at the Royal Institution on his system of transmitting pictures by telegraph, directing special attention to a portable apparatus which he has devised for that purpose, and which has been successfully used for transmission from Brighton to London. Mr. Baker also dealt with the progress made in the transmission of pictures, &c., by wireless telegraphy.

Telewriter and Cable.—It is stated that the Telewriter Co. is setting aside a portion of the public exchange (which will shortly be opened) for the use of groups of subscribers to the cable companies. These groups will be connected by a number of trunk lines to the cable offices, and subscribers will be able to transmit an urgent cable in writing direct to the latter.

Uruguay.—Concessions have been granted to Arturo Zabala, for the establishment of a telephone system in the town of Maldonado; to Saturno Carbajal, for the working of a telephone service in Carmelo and Colonia Arrue, and for the establishment of a telephone system in Colonia; and to Pedro Pomoli, for the extension of a telephone line in Tacuarembo.—*Board of Trade Journal.*

Venezuela.—A concession has been granted to the Provisional President of the State of Trujillo for the establishment of a telephone line between Mendoza and Valera.—*Board of Trade Journal.*

Wireless Telegraphy.—A U.S. Consul says that two circuits of Marconi wireless telegraph have been installed on the Benadir coast in Italian Somaliland. One connects the posts at Mogodishe, Itala, Merka and Lugh; the other Barawa, Giumbo and Bardera. The Merka-Mogodishe line is in active use for both official and commercial business.

Successful experiments have been made recently in fitting steam trawlers with wireless telegraph apparatus, thereby enabling them to communicate with the Dutch wireless station at Ymuiden.—*Board of Trade Journal.*

A Post Office return shows that between March 31st and December 31st last year, 34,496 radio-telegrams were transmitted between the United Kingdom and merchant ships at sea; most of these were dealt with at Crookhaven. At the end of the year 32 licences were held by shipowners in respect of ships registered in the United Kingdom, and 116 vessels were covered by these licences. The revenue derived by the Post Office from the radio-telegrams referred to was £1,120 from coast station charges, and £1,115 from inland telegraph charges. Apart from ship installations, there were 260 licensed stations in the United Kingdom at the end of the year, but of these 241 were licensed for experimental purposes only. In the County of London 58 stations were licensed, all for experimental purposes.

Wireless Telephony.—According to the daily Press, a Mr. Grindell-Matthews has invented a new wireless telephone, for which the usual miraculous properties are claimed.

CONTRACTS OPEN and CLOSED.

OPEN.

Austria.—May 2nd. The Austrian Post and Telegraph authorities in Vienna are inviting tenders for 50,000 metres of rubber-covered wire, 100,000 metres of ordinary wire, and 1,200,000 metres of metallic cable.

Australia.—QUEENSLAND.—June 8th. Six sections of common-battery switchboard and equipment, jumper wire, and cable, for the P.M.G.'s Dept. Tender forms, &c., at the Commonwealth Office, London, S.W. See "Official Notices" April 1st.

May 17th.—1,010 reinforced concrete telegraph poles, for the P.M.G.'s Department, Victoria. Forms, &c., at the Commonweaith Offices, London. See "Official Notices" April 1st.

May 18th.—Paper-insulated, lead-covered, and brass ribbon-tape cable, for the P.M.G.'s Department, Queensland. Forms, &c., at the Commonwealth Offices, London. See "Official Notices" April 1st.

June 8th.—Protectors, small switchboards, and common-battery telephones, for the P.M.G.'s Department. See "Official Notices" April 15th.

NEW SOUTH WALES.—June 1st. Eight sections of common-battery switchboard, for the P.M.G.'s Department. See "Official Notices" April 15th.

May 17th.—Fifty coin attachments for the P.M.G.'s Department in Victoria. See "Official Notices" April 22nd.

Two tons of wire, twisted pair, outside distributing, No. 16 S.W.G., for the P.M.G.'s Department. See "Official Notices" to-day.

June 7th.—One main distributing frame, for the P.M.G.'s Department in Western Australia. See "Official Notices" to-day.

June 14th.—100-party line common battery telephone wall sets; 10-party line common battery table sets; 100 switches, common battery, single extension and intercommunication; and 3,000 telephone protectors, for the P.M.G.'s Department in Victoria. See "Official Notices" to-day.

Belgium.—May 18th. La Société Nationale des Chemins de Fer Vicinaux, of Brussels (14, Rue de la Science), is inviting tenders for the supply of the electrical energy required for the electric railways in the Louvain district.

Bristol.—April 30th. Arc lamp carbons and incandescent electric lamps, for the Docks Committee, for one year. W. W. Squire, engineer, Cumberland Basin, Bristol.

Cape Colony.—The Public Works Department has recently been inviting designs for the supply of electric light and other fittings for the Houses of Parliament, Cape Town. Premiums ranging from five to two guineas were offered for the best designs of each class of article required.

Halifax.—May 14th. Electrical work at new police buildings, for the T.C.; James Lord, Borough Engineer, Town Hall (returnable deposit, £5).

Heston and Isleworth.—May 11th. Extension of the engine room; 250-KW. generating set, boiler feed steam pump, ejector condenser, piping and connections, machine tools, &c., for the U.D.C. See "Official Notices" April 22nd.

Lanark.—May 4th. The District Committee of the Middle Ward of the County of Lanark invite tenders for the supply and erection at the refuse destructor at Bogs Brae, near Bellshill, of one 3-KW. steam dynamo, one switchboard and main cable, and complete wiring installation. Specification at the office of Mr. A. J. Abraham, resident engineer, Electricity Works, Bothwell Street, Cambuslang; deposit £1, returnable as usual.

Leeds.—May 9th. 5¼ miles of ·15 sq. in. extra-high-tension three-core cable, for the City Electricity Department. See "Official Notices" April 22nd.

Littleborough.—May 2nd. H.T. feeder cables, L.T. distributors, &c., and transformer kiosk, transformers, equipment, switchgear, &c., for the U.D.C. See "Official Notices" April 1st.

(*Continued on page* 703.)

ELECTRIC DRIVING AT THE MERSEY MILLS, HOLLINGWORTH.

The March issue of *Vulcan*, the official organ of the Vulcan Boiler and General Insurance Co., Ltd., of Manchester, contains a pithy article on the electric driving of a portion of Messrs. Thomas Rhodes's mill, at Hollingworth, and the successful result which has attended the adoption of this system, as vouched for by the firm in question.

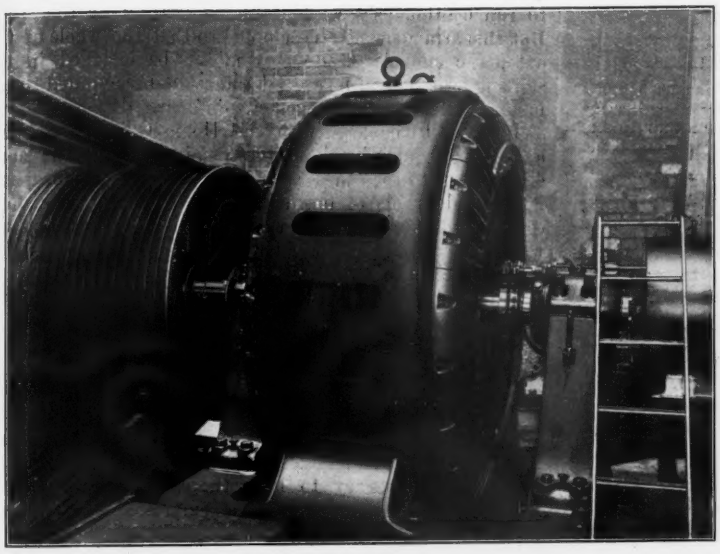


Fig. 1.—Rope-driven 500-kw. G.E.C. Generator, Mersey Mills.

The work was carried out to the specification, and under the supervision of Mr. J. F. L. Crosland, chief engineer to the Insurance Co., and the article in question quotes the fact, now well known to electrical engineers, that the cost of production of power per unit with an electrical installation is not always a reliable gauge of its value to a manufacturer.

The power plant of the Mersey Mills—which comprise spinning mills containing 47,100 weft spindles, 33,178 twist spindles, 5,928 ring spindles, and a shed containing 1,855 looms—had been thoroughly overhauled in recent years, under the Insurance Co.'s supervision, inasmuch as that four obsolete engines, and nine low-pressure boilers, were replaced by two high-class vertical triple-expansion engines of 825 H.P. and 1,340 H.P. respectively, supplied with superheated steam at 200 lb. pressure.

This resulted, as expected, in more economical working and increased production, but the regularity of transmission of power was not all that could be desired, and an investigation showed that while the engines were working with a total periodic fluctuation of speed per revolution, which was less than 1½ per cent., yet, in the case of one of the spinning mills driven by No. 1 engine, the irregularity of turning was increased to about 12 per cent., and in the case of a spinning room driven by No. 2 engine, the irregularity exceeded 15 per cent.

The illustrations of the speed diagrams given on page 692 are very instructive, especially when figs. 5 and 7 are compared with figs. 6 and 8 respectively, showing the speed variation obtained with the electrical drives.

As a result of this investigation, it was decided to adopt electrical driving for such parts of the spinning mill as involved indirect mechanical drives, whilst, at the same time, modifications were made so that the whole of the weaving shed could be driven by No. 1 engine, and the whole of the spinning mill by No. 2 engine.

To carry out the electrical installation, the lower second motion shaft of No. 2 engine was removed and a G.E.C. 500-kw. (625 k.v.a.) three-phase generator, with direct-coupled exciter, installed, rope-driven from the engine.

The switchboard is of modern design, as shown in our view; a separate three-core cable runs to each motor, and these are each provided with triple-pole main and starting switches.

In order that the overlooker in each electrically-driven room may know when the alternator has attained its full E.M.F. and he is able to start, a couple of incandescent lamps are fitted over each starting switch, whilst in addition there has been fixed for the engine driver, close to the engine stop valve, a voltmeter (fig. 9) and a subsidiary shunt resistance in the exciter circuit; the voltmeter, of course, is connected across the main alternator leads. Under the voltmeter are seven switches, each of which operates a bell in the respective rooms, so that immediately the full voltage has been obtained, the attention of the overlooker in each room is attracted by a loud ringing bell, in addition to the lights mentioned as being over the starting switches.

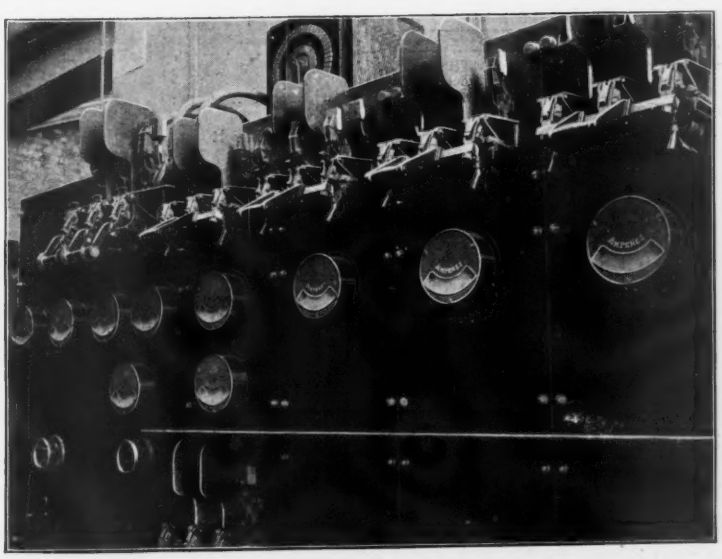


Fig. 2.—The Main Switchboard, Mersey Mills.

The current is conveyed from the switchboard to each motor along three-core bitumen insulated armoured cable,

and as far as possible the cables are run along the walls outside the mill. Six cables are taken out through the wall at the back of the switchboard, where three run to the right and three run to the left.

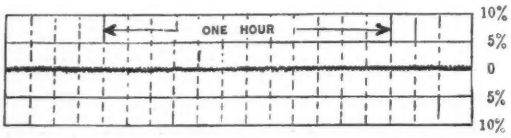
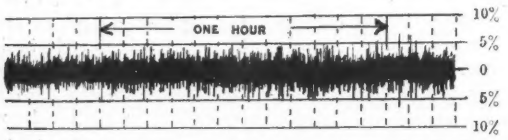
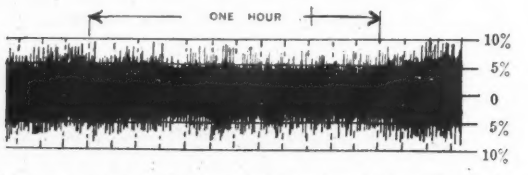


Fig. 3.—Speed Fluctuation, No. 2 Engine, May 22nd, 1909.



Taken at a point to which power was brought from No. 2 engine, first by a rope drive to the second motion shaft, and then along 95 ft. of the second motion shaft.

Fig. 4.—Speed Fluctuation Diagram; No. 2 Spinning Room, November 14th, 1908.



Taken at a point to which power had been brought from No. 2 engine (1) through rope drive to second motion shaft; (2) along 95 ft. of this shaft; (3) through a pair of bevels; (4) through 50 ft. of vertical shaft; (5) through another pair of bevels; (6) along a horizontal shaft 40 ft. in length.

Fig. 5.—Speed Fluctuation Diagram; No. 2 Spinning Room, November 27th, 1908.

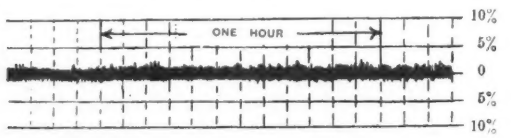
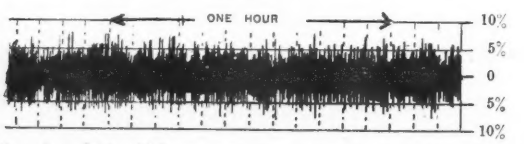


Fig. 6.—Speed Fluctuation, Electrically Driven Shaft, No. 2 Spinning Room, December 17th, 1909.



Taken at a point to which power was brought from No. 1 engine (1) through one rope drive to second motion shaft; (2) a second motion shaft 10 ft. long; (3) a pair of bevel wheels; (4) a vertical shaft 16 ft. high; (5) a second pair of bevel wheels; (6) a horizontal shaft 140 ft. long; (7) a third pair of bevel wheels; (8) a cross shaft 16 ft. long.

Fig. 7.—Speed Fluctuation Diagram, No. 4 Spinning Room, November 5th, 1908.

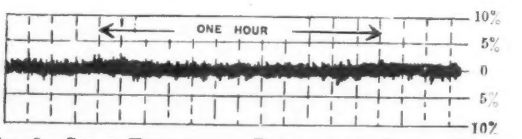


Fig. 8.—Speed Fluctuation, Electrically-Driven Shaft, No. 4 Spinning Room, February 5th, 1910.

Six motors of the wound-rotor induction type are installed; three of these are capable of developing 120 H.P. each, and three capable of developing 90 H P. each.

The motors drive the following rooms:—Twist card room, spinning cellar, winding room, two spinning rooms, and frame room.

In one spinning room and the spinning cellar the motors are fixed in separate chambers, and the line shaft is extended through the wall so that the motors are entirely separated from the room in which the power is required. In these cases, however, the starting switches are fixed on the wall in the room in which the driven machinery is situated.

In the twist card room and winding room, the motors are fixed on the wall, but in the case of the new side spinning room and the frame room the motors are carried on massive girders.

It will be seen that it is necessary for each motor to be started in the room where the driven machinery is placed, and the starting switch is enclosed for protection against fire in a sheet-iron case fitted with a glass front. The switch itself is fixed near the ceiling, and the lever is operated by a steel rope attached to a small ratchet wheel which is placed at a convenient distance for operation by any authorised person.

The view of the ring spinning room, fig. 11, clearly shows the motor and the case of the starting switch, and also the two indicating lamps fixed on the top of the case. The whole of the control is effected at the starting switch, so that the rotor slip-rings are never short-circuited. This is an unusual feature, and particular care had to be taken in the design of the slip-ring gear to enable the machines to run continuously without undue heating at this part. But this arrangement was adopted so that the whole of the automatic no-volt release gear might be included in the starting switch, and no special attention be required to the motor itself when the current was interrupted.

In order to conform with the Home Office regulations, a triple-pole quick-break switch was included in the main circuit close to each motor. Except in cases of emergency it is not desirable to operate this switch, and, therefore, each switch is enclosed in a cast-iron lock-up box, but the key is enclosed in another small box fitted with a glass front and fixed close to the switch, so that in case of emergency the glass may be broken and the key obtained without loss of time.

Fig. 10 shows the arrangement of the motor for the frame room and the triple-pole switch. In this case the starting switch was fixed on the other side of the wall, as this was a more convenient position.

As a considerable amount of fly and fluff often collects in motors situated in such positions as those at the Mersey Mills, it is necessary to have the machines blown out periodically. For this purpose a compressed-air equipment is provided, from the receiver of which blower pipes are run to each motor, and the motors are periodically blown out by air at a pressure of 60 lb. per sq. in., a flexible rubber connection being made between the end of the pipe and the nozzle used for blowing out the motor.

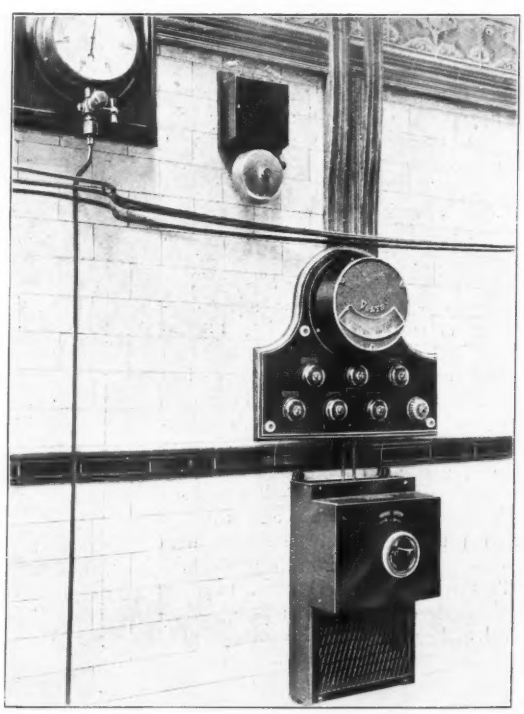


Fig. 9.—Engine Room Indicator, for Starting up Motors.

The whole of the installation has been carried out by the General Electric Co., to whom we are indebted for our views.

Messrs. Thos. Rhodes & Co. state that they are

entirely satisfied with the results of the electrical driving, and that the regularity of turning, which was the particular point aimed at, is all that could be desired. It was not expected that any reduction in the power required to drive the load would take place. Actually, a slight increase in power occurred, but as a set-off against this increase, the production of yarn on the spindles driven electrically has been increased by about 6 per cent., and the yarn produced is of a very superior quality.

It must be borne in mind that this improvement has been secured at a mill which was previously working as efficiently as was possible with a system of mechanical transmission.

Messrs. Rhodes further say that the very regular turning has resulted in the practical extinction of repairs to the machinery, and that the mules now require scarcely any attention.

The adoption of electrical transmission has also permitted a considerable length of horizontal shafting as well as two vertical shafts to be dispensed with, while a large number of bevel wheels have been put out of use, thus effecting a considerable saving in lubrication, attention and repairs.

Finally, the result of the replacement of the old engines and boilers, the renewal of 72,000 spindles and of all the card-room machinery, and the addition of 5,928 ring spindles has enabled Messrs. Thos. Rhodes & Co. to increase the number of their looms from 1,350 to 1,855, which are supplied by yarn spun on the premises. Owing to these changes an increase of over 26 per cent. in production has been secured, even after allowing for the increased amount of yarn spun by the additional 5,928 ring spindles. In addition to these advantages the consumption of coal, which was about 145 tons per week before the renewal of the engines, boilers and machinery, has been reduced to an average of 120 tons per week—a highly satisfactory result after taking into account the great increase in general production.

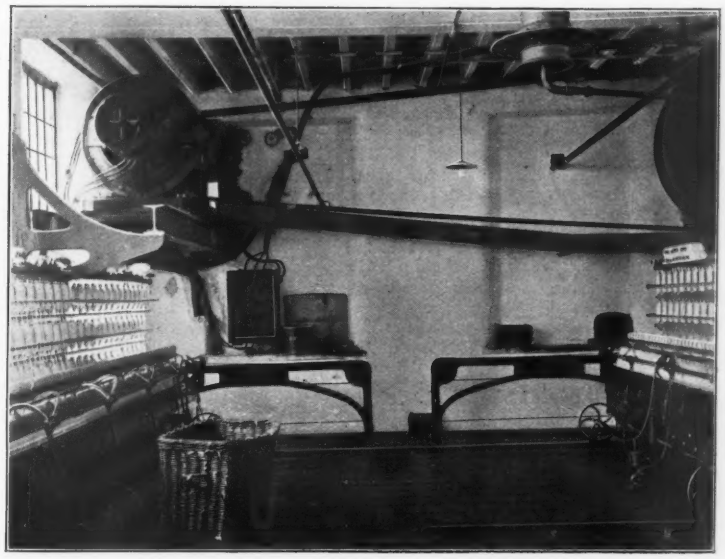


Fig. 10.—Motor and Triple-oil Switch in Frame Room.

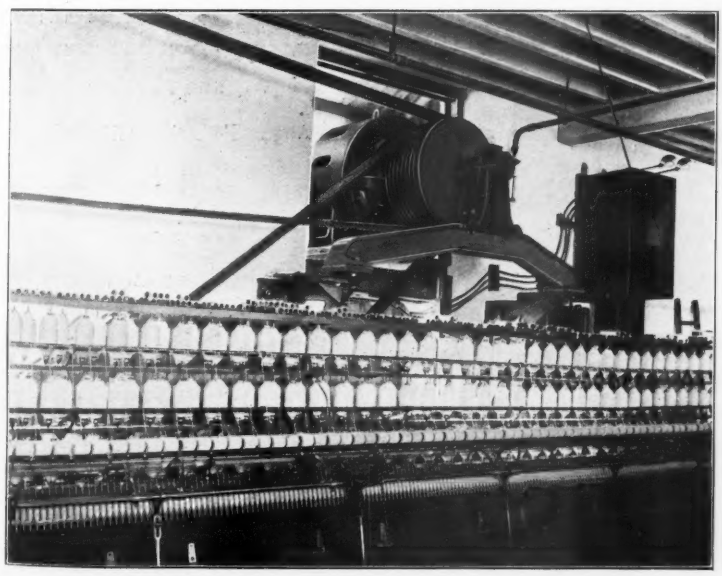


Fig. 11.—Motor and Starting Switch, Ring Spinning Room.

Concert.— Yesterday (Thursday) evening the second annual concert by the band of the Metropolitan Electric Tramways Athletic and Social Club was to take place at the Alexandra Palace.

Cooling Towers.

Messrs. W. H. Roy & Co., of Manchester, have made a speciality of water-cooling plant, being builders of several patented types of cooling towers, which have been largely adopted in connection with textile and other condensing plants.

These towers are constructed entirely of timber (no nails being used), and are of the open type—as supplied to the Huddersfield Corporation electricity works—and chimney type; they are all fitted with patent dripper bars, which have been designed as the outcome of experiments in providing the necessary distribution of the water.

The cooling laths are fixed at each end, giving much greater resistance to deflection than in the case of merely supported laths.

Great stress is laid on the durability of the "Roy" cooling plant, which has now been developed solely on the "lowest tender" basis; a saving of 15 per cent. in ground space and cost of foundations is claimed as compared with ordinary practice, due to the use of vertical sides, also a saving in power due to economy in water circulation and decreased lift as compared with ordinary practice amounting to 40 per cent.

Messrs. Roy are also specialists in condensing plant of the barometric counter-current jet and other types; dry air pumps; exhaust steam oil separators; exhaust head silencers, &c.

Galloway Engines.

As we have previously said, Messrs. Galloways, Ltd., have secured the sole British manufacturing licence for the Ehrhardt & Sehmer gas engines, which are noteworthy for their built-up cylinders, and consequent freedom from cracks and breakages, their simplified valve gear, and patent crosshead. The jacket casing is clipped on to the cylinder body casting through flexible rubber or gutta-percha joint rings, permitting the cylinder to expand freely; it can readily be removed to enable the water spaces to be thoroughly cleaned—a matter of great importance. Accessibility, in fact, is a special feature of the design of this engine. The makers recommend the use of gas engines in preference to steam engines for such purposes as driving doubling mills which work night and day, as under these conditions the fuel economy of the gas engine more than outweighs the greater capital cost.

Their steam engines, which have been much used for cotton-mill driving, are now made with a new patent type of drop-piston valves, which has given very satisfactory results. Their engines, both steam and gas, are well adapted for driving low-speed electric generators.

Messrs. Galloways have recently re-designed their boilers also, and have eliminated the troubles often experienced with Lancashire boilers working at high pressure, owing to lack of flexibility sufficient to permit of free expansion between the furnaces and the shells of the boilers.

ELECTRIC INDIVIDUAL DRIVE IN CONTINENTAL TEXTILE MILLS.

WITH DESCRIPTION OF THE COMPLETE EQUIPMENT OF ALL MACHINES ON THE SINGLE-DRIVE SYSTEM AT MESSRS. BUCHALY & HERBERTZ'S NEW MILL, M.-GLADBACH.

By W. R. ROTHENBERG.

(*Concluded from page* 601.)

The plan of the works, given on page 599, shows the arrangement of the installation at Messrs. Buchaly and Herbertz's mill, M.-Gladbach, and, as everything is clearly shown, it is not necessary to go into detail. As will be seen,

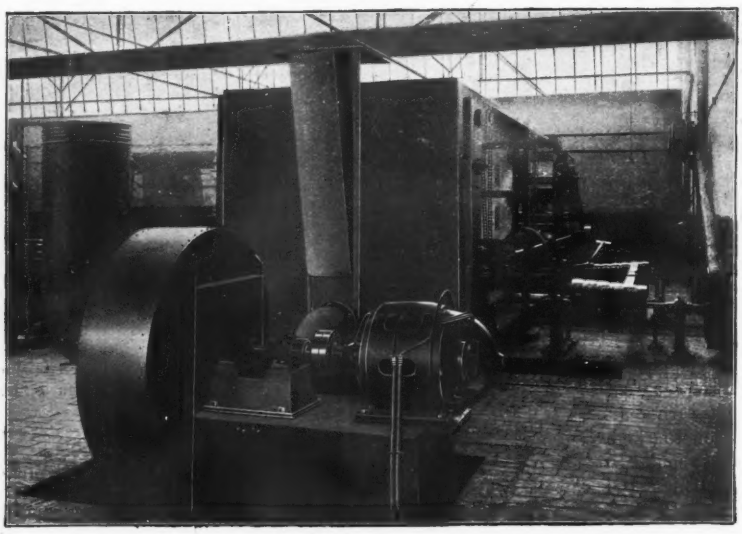


Fig. 8.—Tentering Machine.

the weaving shed, which has an area of about 135 ft. × 135 ft. = 18,225 sq. ft., has only four main columns.

Electricity is brought into the mill from the M.-Gladbach Electric Supply Co. in the form of three-phase current at 5,000 volts, and is reduced by the transformer in the mill to the working pressure of 190 volts.

The transformer room (fig. 10) is completely separated from the rest of the building as far as the high voltage is concerned, so that it is quite impossible to touch any high-tension cable, apparatus, &c.

From the transformer room the cables are led in channels in the floor to the point of distribution; the channels are covered over with plates, so that the cables can be inspected at will.

The single-drive system is adopted throughout, and all motors are of the totally enclosed type. The motors, therefore, cannot possibly get choked with dust. The only attention required is to occasionally fill the ball-bearings with oil and to keep the exterior of the motors clean.

The tentering machine (fig. 8) and the sizing machine (fig. 9) are each fitted with two A.C. motors to do away with the usual gearing and shafting, thus making the arrangement compact and very much simpler.

The larger motors, such as those used for the raising and calendering machines, &c. (figs. 11 and 12), are fitted with star-delta switches in controller form, but ordinary starting switches are supplied with motors up to 2 H.P.

Fig. 12 shows the drive of a calendering machine, and fig. 13 that of the finishing machine.

The driving of the doubling machines (fig. 14) is arranged so that each machine has two motors. The latter are provided with stepped pulleys, so that the variations in speed necessary for these machines may be obtained without extra gearing. In view of the long extension of the motor shaft due to such pulleys, the three motor bearings are of special design, to prevent any bending of the shaft.

As each side of the doubling machines is driven by a separate motor, the one is entirely independent of the other, which is in many respects a decided advantage.

The driving of the looms is effected by means of belts, the motors being fitted with ball-bearings and mounted on automatic spring belt-tightening bases, as can be seen from fig. 15, showing the loom-shed at Messrs. Buchaly and Herbertz's, where the whole of the looms are of English manufacture; while figs. 17 to 21, page 697, show other large weaving sheds completely fitted out with "Schorch" single-drive motors—C. Delius, Aix-la-Chapelle; A. Ferber, Aix-la-Chapelle; Messrs. Zopfi, Ranica; and Bausch & Huetzen, Odenkirchen. The single-drive installation at the last-named mill has now been running over five years, and it has been shown there that the depreciation of the motors and plant is very small, certainly much less than with the shaft drive.

In the case of Messrs. August Ferber's woollen mill, where

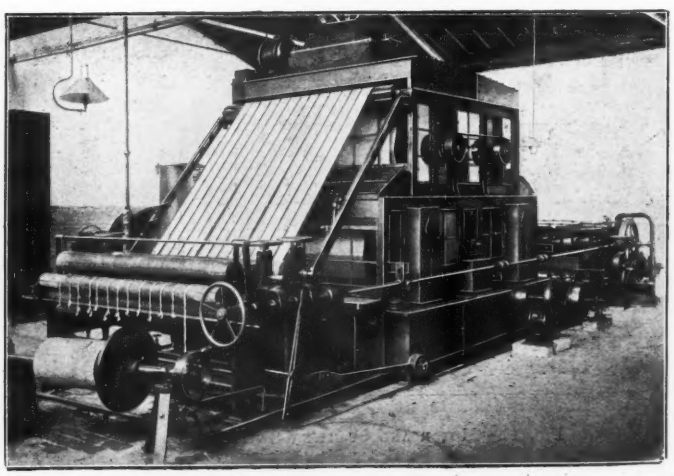


Fig. 9.—Sizing Machine.

a few hundred single-drive "Schorch" motors are installed, it is interesting to hear the reasons why these motors were adopted. Messrs. Ferber, of Aix-la-Chapelle, had the enlargement of their woollen mills under consideration a short time ago, and were anxious to decide which kind of drive would prove the most advantageous for the new looms, &c., they were

about to put up. Their extensive mills were driven at the time on the shafting system, from one of their steam engines.

In connection with the extensions, they had to consider either additions to their existing shafting or the adoption of electrical driving, in which case the installation would be connected to the three-phase mains of the Aachen Electricity Works.

Again, in considering the question of electrical driving, it was of the greatest importance to decide which was the preferable, single or group drive. Messrs. Ferber, therefore, invited various motor manufacturers to undertake trials in their mill, in order to clear up the above-mentioned question. These tests were to be carried out for the group drive as well as for the single drive. With this object in view, a short shaft for five looms, driven by one electric motor, was fixed up in the above mill. At the same time five other looms were equipped with individual motors. The tests lasted a considerable time, and were very carefully carried out. Each loom was fitted with a pick counter in order to record the exact production. The results arrived at by careful comparison of the production of the looms and the power consumption, with group drive as well as single drive of the looms, made Messrs. August Ferber quite convinced that single driving was the best system to adopt. Furthermore, by means of these tests it was proved that electrical driving was much more advantageous than mechanical driving.

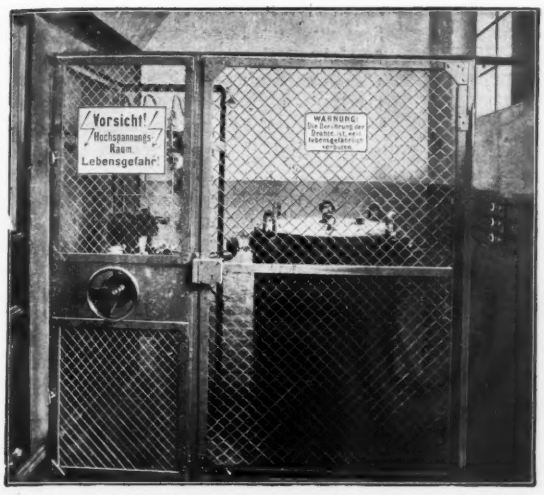


Fig. 10.—Transformer Room.

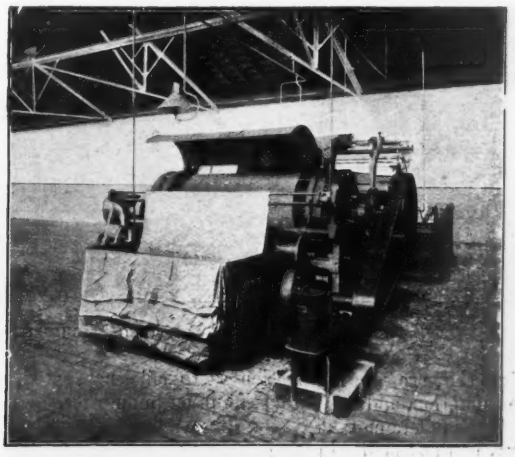


Fig. 11.—Raising Machine.

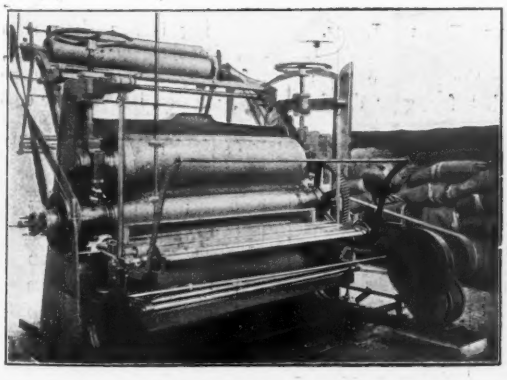


Fig. 12.—Calender.

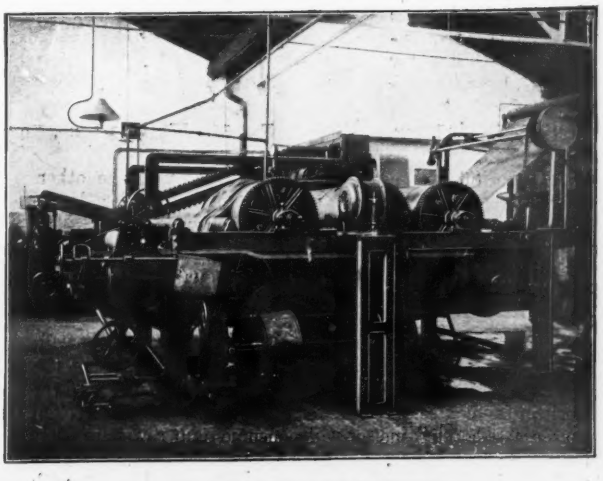


Fig. 13.—Finishing Machine.

Messrs. August Ferber were unable at the outset to arrive at a decision as to which was the best make of motor to adopt, owing to the careful trials of the competing firms. Although the result of these trials showed that the "Schorch" motor was greatly superior to the others, still the order was not given to the Schorch Electrical Co. for the time being, chiefly because the price submitted was higher than that offered by their competitors.

The argument that a higher price was the natural corollary to a greater perfection, and especially to a higher degree of efficiency, was not accepted as sufficient; for the principal competitor guaranteed 82 per cent. efficiency, whilst the Schorch Electrical Co. guaranteed 84 per cent. But the Schorch Electrical Co. were guaranteeing this efficiency in a general way—*i.e.*, for all power requirements of the looms—while their competitors only guaranteed 82 per cent. as their maximum efficiency.

Messrs. August Ferber now suggested that in order that they might clear this matter up once and for all, an impartial and most exacting test should be undertaken with the motors submitted, in the presence of representatives of the two competing firms.

This suggestion met with the approval of the motor makers. The experiments were carried out, with the consent of the competing firms, in the Electrical Branch of the National Steam-Boiler Inspecting Department in Aix-la-Chapelle, an institution somewhat similar to the National Physical Laboratory. The tests—at which, as already stated, the representatives of the competing firms were present—were carried out in the following manner:—

First of all, one motor was subjected to a brake test, and then the other machine was submitted to the same test, so that, should the instruments not register quite correctly, the result of the trial, so far as was necessary for the comparison of the motors, could without hesitation be

accepted as relatively correct. The results of the calculations can be seen from the accompanying diagram (fig. 16), which gives the necessary information as to efficiency, speed, watt consumption, and current consumption in amperes.

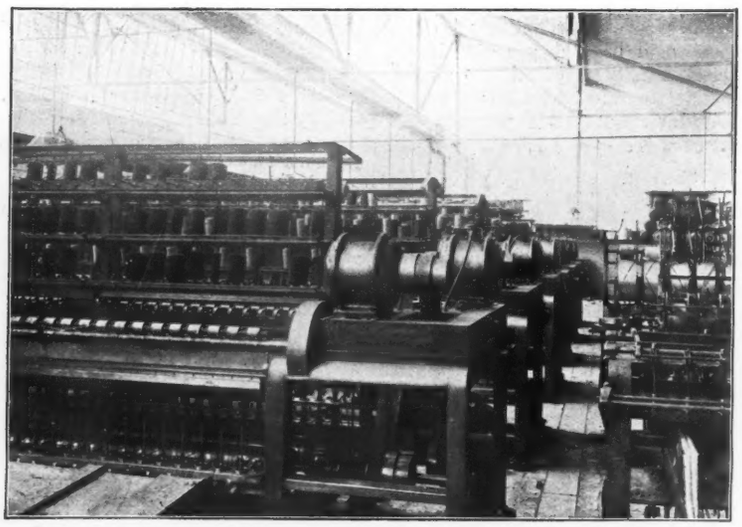


Fig. 14.—Doubling Machines.

The most important curve illustrated in this diagram is the one for efficiency. This curve shows that the "Schorch" motor with 0·45 H.P.—*i.e.*, under half-load—already has an efficiency of 84 per cent. At full load, this same motor reaches 87·5 per cent., and the efficiency does not fall below 84 per cent. until the output is 1·45-H.P. (about 50 per cent. overload). When considering the various power requirements of such a motor for single drive, it can be taken for granted that the "Schorch" 1-H.P. motor has an average efficiency of 86 to 87 per cent. The efficiency of the other motor increases much more gradually, so that with a lower load the efficiency is considerably below the maximum value. With a load of 0·45 H.P. the efficiency is only 68 per cent.; and the highest point reached is 79 per cent., so that the guaranteed degree of efficiency of 82 per cent. is never attained at all.

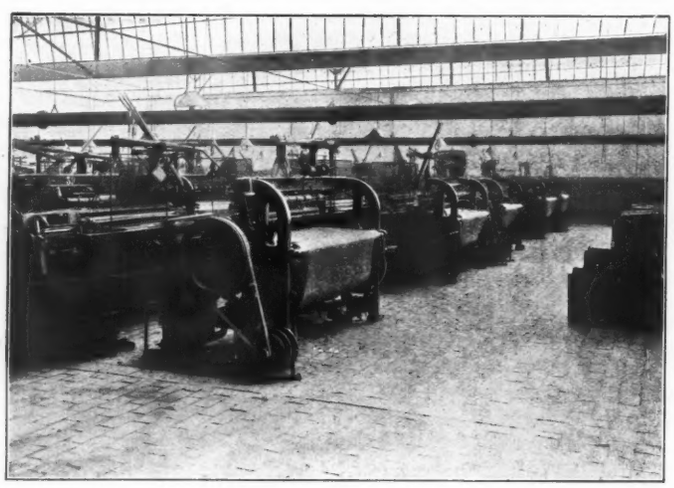


Fig. 15.—Weaving-Shed, Equipped with English Looms.

The watt consumption of the "Schorch" motor at all the various loads is about 100 watts lower than that of the other motor. This means that if, for instance, a loom is at work in the course of a year for 2,000 hours, one can reckon that a "Schorch" motor will consume 200 KW.-hours less than the other motor. Calculating ½d. for one KW.-hour—and this is about the cheapest price likely to be met with in large mills—one can see, therefore, that a "Schorch" motor consumes about 8s. less in energy per year than the other motor. Therefore, allowing 10 per cent. for interest and depreciation, the "Schorch" motor would be actually the cheaper, even if it cost £4 more than the other motor.

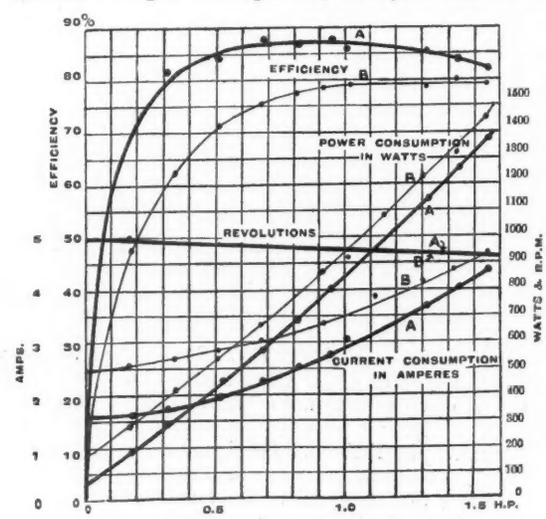
In connection with smaller textile mills, as a rule, the price per KW.-hour is rather higher than ½d., so that the value in most cases of a "Schorch" motor is, on account of its high efficiency in comparison with any other motor, still higher than has been stated above.

The test shows that the decrease in speed with the "Schorch" motor is also somewhat smaller than with the other motor. At this point it is as well to point out that the "Schorch" motor was built for a normal load of 1 H.P., while the other motor was the maker's 1·5-H.P. standard size. The tests made by Messrs. August Ferber before the beginning of these experiments showed that the power consumption of the loom was about 1 H.P., and for this reason 1-H.P. motors were supplied by the various firms for this trial; but the trials also showed that the so-called 1-H.P. motor of the competing firm was not large enough, and therefore they submitted a 1·5-H.P. motor, which consequently was employed for the brake test.

In spite of the nominally higher output of the other motor, the decrease in speed of the latter was appreciably greater than that of the "Schorch" motor. The noticeable differences in the prices submitted were explained for the most part in this manner. No sooner had Messrs. August Ferber the results in their hands, than they decided once and for all to adopt "Schorch" motors throughout the mills.

By means of the foregoing carefully carried out experiments it was clearly shown:—1. That the electrical individual drive was decidedly preferable to either electric group drive or mechanical drive. 2. That the "Schorch" motor for individual drive of textile machinery was in every respect very much superior to other makes of small three-phase A.C. motors, and could be adopted generally for this purpose without the slightest hesitation.

Belt drive is considered superior to gear driving, in the first place, because the first cost of belting is less than that of gearing; secondly, because the power consumption for belt drive is not more than that for gear driving; and, thirdly, because the cost



A, "Schorch" 1-H.P. motor; B, Competing 1·5-H.P. motor.

Fig. 16.—Efficiency, &c., Curves of Loom Motors.

of repairs of gearing is greater than that of belting on account of the heavy wear of the teeth.

If toothed gearing were adopted an elastic coupling would be required, but in the case of belting this extra is not necessary, as, of course, the belt itself plays the part of an elastic coupling, and in a much more satisfactory manner than is possible with the former.

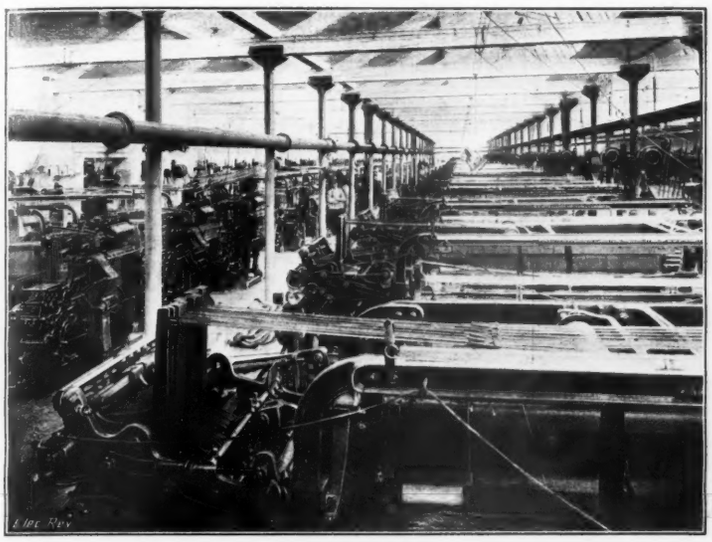


Fig. 17.—Loom-shed of Messrs. C. Delius, Aix-la-Chapelle, equipped with Schorch Single-drive System.

It has been proved in all cases that the individual drive *by highly-efficient three-phase induction motors* makes it certainly well worth while to equip each loom with a motor. The installation is effected in such a way that the weaver need know nothing about the motor, there being nothing more than the usual shipper handle to operate, which is connected to a small starting switch fixed on the floor; on throwing it in, the loom starts immediately at speed, and on throwing it out the loom stops, in the usual way.

It has frequently been said that the Schorch Electrical Co. are on principle opposed to gear driving for looms, but this is by no means the case. The company adopt gear driving when advantages are to be gained by so doing, but when this is not so, and when better results can be obtained by belt drive, they, of course, adopt the latter system.

It may, however, be mentioned that results obtained by the Schorch Electrical Co. from exhaustive tests and actual installations in mills carried out by them—they have erected during the last few years over 8,000 single-drive motors for looms alone in various mills—point to a much wider range of application for belt drive than for gear drive.

If the single drive is to become more widely adopted in this country, full use must be made of the advantages to be gained from this system. In this respect the new installation of Messrs. Buchaly & Herbertz, at M.-Gladbach, satisfies the most stringent demands that may be made upon it, and for this reason it should do much to create interest in the single-drive system in wider circles here.

Messrs. Buchaly & Herbertz have expressed to the Schorch Electrical Co. in a letter their great satisfaction with the installation, confirming in every respect the statements made in the foregoing concerning the single-drive system. They are especially pleased to find that the actual power consumption is even less than the low figure originally guaranteed by this company.

It may be added that the Schorch Electrical Co. are carrying out at present a few large installations on the single-drive system for a number of English textile mills.

Fig. 18.—Doubling Frames, Messrs. Bausch & Huetzen.

Fig. 19.—Loom-shed, Messrs. Zoppi, Ranica; 700 Schorch Motors.

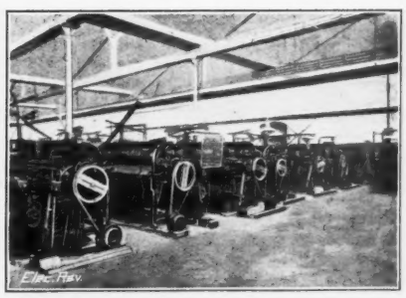


Fig. 20.—Loom-Shed, Messrs. Bausch & Huetzen.

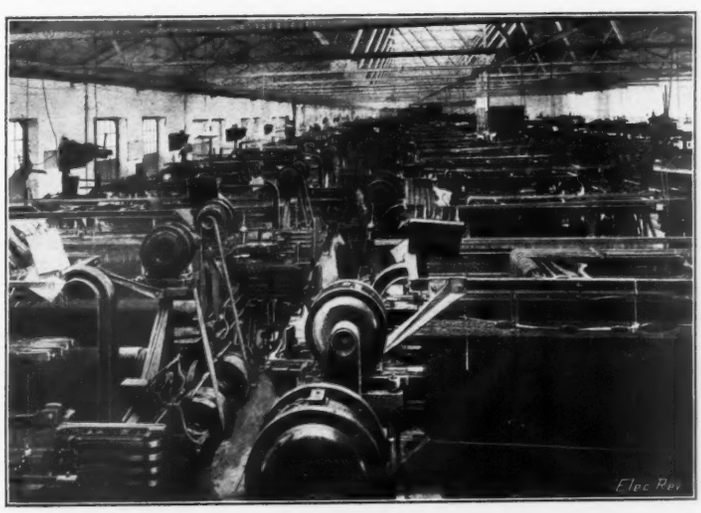


Fig. 21.—Loom-shed of Messrs. August Ferber, Aix-la-Chapelle.

The B.A., 1911.—Next year the British Association will hold its gathering at Portsmouth. The Town Council last week voted the necessary grant, notwithstanding the ignorant protest of a Labour member, who thought that the members could very well afford to entertain themselves!

APPARATUS FOR TEXTILE FACTORIES.

The Oerlikon Co.

The Oerlikon Co. have recently introduced from the Continent a system of driving ring-spinning frames, which, to judge from results, has already proved itself well worthy of attention in this country.

It is well known to the spinner that the tension of the thread varies with the different diameters of the cop, being greatest where the smallest portion of the cop is being formed and least at the largest diameter; this variation, occurring with each lift of the ring rail, takes place between the traveller and cop. This has been a prolific cause of broken ends and uneven winding, and it has naturally led to many proposals for overcoming these known defects.

The traveller performs the double function of twisting and winding the thread in a continuous process; it exerts a constant drag on the thread with constant spindle speed, instead of varying it according to the diameter of the cop. This difficulty can only be got over by varying the frictional resistance to the traveller—*i.e.*, by varying both its speed and the spindle speed with each upward and downward movement of the ring rail; suitable means have been devised by the Oerlikon Co., which embody one or two earlier proposals and achieve the desired result.

In the first place, the Oerlikon Co. have designed a special three-phase motor, fig. 5, with similar speed regulation characteristics to the direct-current type.

The speed can be varied from 600 to 1,430 R.P.M. when running, by moving the brushes. One set of brushes is provided per pair of poles.

The motor is dust-tight and arranged for ventilation from outside; it is provided with ball bearings, and a starter is fixed on the top, as shown in our views.

The automatic apparatus for varying the speed is shown diagrammatically in figs. 3 and 4, in which the movement of a rope T, attached at G to another rope A B, causes a movement of the lever B C, resulting in travelling the brushes E over the commutator, and thus varying the motor speed.

The brushes undergo a slowly advancing and continuously oscillating movement during the formation of the cop, under the general control of the rope T, and this results in a speed diagram such as shown in fig. 6, which represents the fundamental basis of the Oerlikon drive. In this diagram, line *a* represents the maximum spindle speed, line *b* the minimum spindle speed (when spinning the smallest diameter of the bobbin); the distance *t* shows the time for one up-and-down movement of the ring-rail—the zig-zag lines representing the variations in spindle speed; the distance T indicates the time taken for the whole operation of forming the cop; the falling line A B represents the gradually decreasing speed required for successfully forming the conical end or nose of the cop.

In order to overcome the inertia of the spindle and ensure that the apparatus governing the regulation of motor speed shall be in advance of the movement of the ring-rail by an amount exactly equal to the tendency to lag when changing speed, the Oerlikon Co.

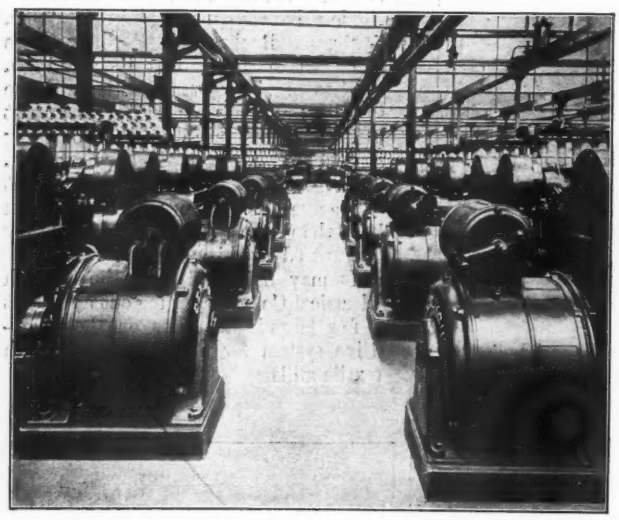


Fig. 1.—Spinning Mill Equipped with Oerlikon Drive.

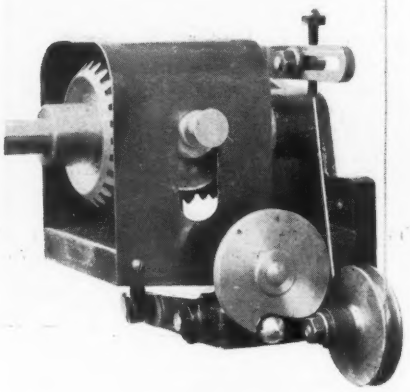
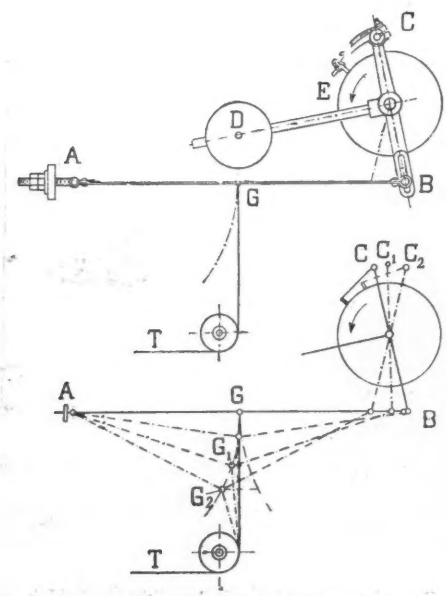


Fig. 2.—Mechanism for Timing and Controlling Speed of Motor.



Figs. 3 and 4.—Mechanism for Moving Brushes and Varying Motor Speed.

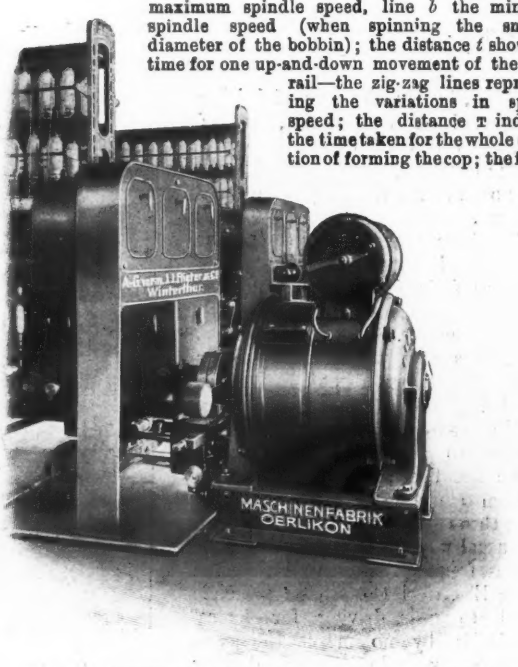


Fig. 5.—Oerlikon Motor Driving Ring Spinning Frame.

have patented an automatic mechanism, shown in fig. 2, which operates the rope T referred to in figs. 3 and 4. This is a purely mechanical device (which has been described at length in a pamphlet on ring spinning recently issued by the company) for imparting the oscillating and gradual continuous movement to the brushes of the motor until the completion of the bobbin, when, under the influence of the balance weight, the brushes are returned to their original position.

In order to show the practical value of the Oerlikon drive, certain tests have been carried out on a Rieter ring frame at Niedertöss spinning mill. The results of these tests are given below, and for

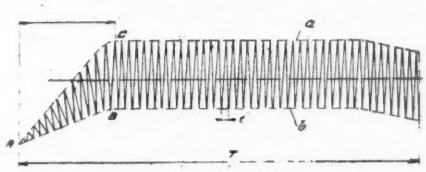


Fig. 6.—Speed Diagram during Formation of Cop.

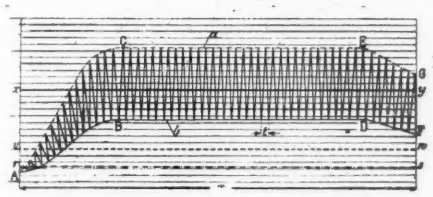
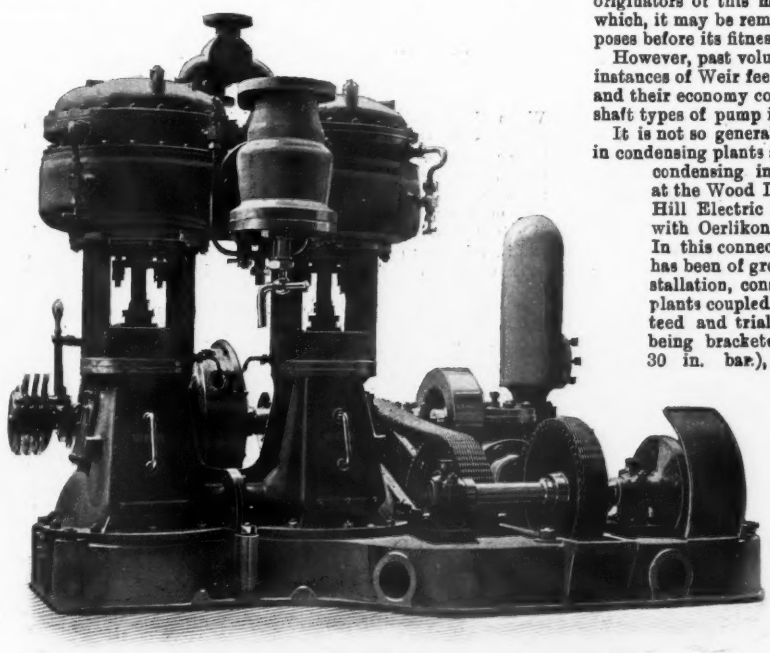


Fig. 7.—Speed Diagram, No. 3 Machine (below).

comparison, the results of two belt-driven frames are also given. White Mako with 32 to 34 mm. staple, once carded and once combed, was spun on each machine with 20 hank roving two ends up:—

Machine:—	*No.* 1.	*No.* 2.	*No.* 3.
Drive	Belt	Belt	Electric
Number of spindles	400	400	400
Revolutions of spindles	7,450 constant	8,000 constant	9,800 variable
Counts	80's warp	80's warp	80's warp
Twist (coefficient)	3·4	3·4	3·4
Production in 52 working hours...	122 lb.	133 lb.	162 lb.
Production compared with electrically-driven machine ...	29·5 % less	21 % less	—
Calculated production compared with No. 3	31·4 %	22·5 %	—
Traveller No.	16/0	16/0	18/0



Weir Electrically-Driven Water and Dry Air Pumps.

Besides the increase in production, it was observed that a lighter traveller could be used on coarse and medium counts with the variable speed drive; in spite of the lighter traveller, the bobbins from machine No. 3 were 6 per cent. lighter than those of equal yarn volume from the other machines, and the winding was much superior. No increased tendency to broken ends was noticed, in spite of the increased spindle speed. Fig. 7 shows the speed diagram for No. 3 machine drive.

An ingenious arrangement recently devised by the Oerlikon Works for motors driving looms is shown in fig. 8. As a rule, such motors are pivoted at one side, and spring-supported at the other, and the range of movement thus made available is limited to a small amount. In the Oerlikon arrangement the

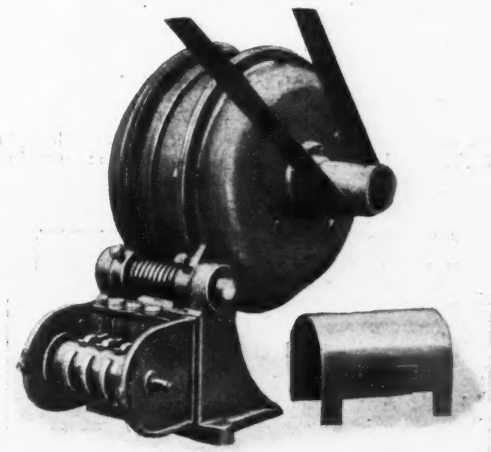


Fig. 8.—Oerlikon Loom-Motor.

motor is supported upon an axis as shown, with part of its weight resting on the belt, and a spring is coiled round the pivot, the resultant action of the spring and the weight of the motor being such that the belt may stretch to a considerable extent without materially altering the tension. The range of motion amounts to about 50°, equivalent to a stretch of 24 cm., within which the tension is constant. The device, moreover, is very elastic in its application, enabling the direction in which the belt is taken off to be varied widely.

The switch controlling the motor is shown in the figure combined with the base-plate, and space is found inside the switch-box for the fuses. The motor is completely enclosed, and provided with ball bearings.

G. & J. Weir, Ltd.

No introduction is required by the average engineer to the Weir feed pump; we believe the firm were practically the originators of this much-used type of direct-acting steam pump, which, it may be remembered, was largely adopted for marine purposes before its fitness for the central station was recognised.

However, past volumes of the Electrical Review reveal many instances of Weir feed pump installations in use at central stations, and their economy compared with the ordinary duplex and crank-shaft types of pump is too well known to need emphasis here.

It is not so generally known that Messrs. Weir also specialise in condensing plants and equipments, although two Weir-Uniflux condensing installations have been in use for some time at the Wood Lane station of the Kensington and Notting Hill Electric Lighting Companies, working in conjunction with Oerlikon turbine plants, under stringent conditions. In this connection also the firm's long marine experience has been of great value. In the case of the Wood Lane installation, consisting, as mentioned, of two condensing plants coupled to 1,600-kw. Oerlikon turbines, the guaranteed and trial results were as follows, the former figures being bracketed: Vacuum in exhaust pipe (28 in. at 30 in. bar.), 28·1 in. at 30 in. bar.; hot well temperature (not less than 92° at 28 in. vacuum), 95° at 28·1 in. vacuum; inlet circulating water (75°), 75°; discharge circulating water (not less than 90° at 28 in. vacuum), 95° at 28·1 in. vacuum; air and water pump H.P. (10 B.H.P.), 6 B.H.P.; circulating pump H.P. (70 B.H.P.), 55 B.H.P.; lb. steam condensed per hour per sq. ft. of surface (10 lb.), 9·6 lb. Owing to the low steam consumption of the turbine, it was not possible to obtain a greater load for the condenser than 9·6 lb. per sq. ft.

In the case of the Wood Lane plant, it was necessary to use a minimum quantity of circulating water consistent with an approximate 28 in. vacuum, and to return it to the cooling towers at high temperature; the small quantity actually used is shown by the saving in power for circulating purposes, and even in this connection, it must be remembered that the pumps deliver the water against a head of 35 ft. If deductions for this work are made, it will be found that the power for circulating purposes is 18 B.H.P., or ·9 per

cent. of the total turbine power; adding 6 B.H.P. for the air and water pump, we find that the power required for condenser auxiliaries at 28 in. vacuum and 75° inlet is 1·2 per cent. of the main turbine power. This is an example of Weir plant designed for particular conditions; the electrically-driven water and dry air pumps are shown on page 699.

Messrs. Weir have special designs of steam-driven combined air and circulating pumps, or for larger plants where separate centrifugal or direct-acting circulating pumps are fitted, their Monotype direct-acting air pump can be used. This pump has now been fitted to over three-quarters of a million I.H.P.

Ferranti, Ltd.

Some very large switchboards for textile mills have been supplied by Messrs. Ferranti, whose record in the development of switchgear is too well known to need extended reference here.

As a small example of the class of work carried out by the firm, fig. 1 shows a low-tension three-phase switchboard supplied to

Fig. 1.—Ferranti Low-Tension Three-Phase Switchboard.

Messrs. Murland & Co., Annsborough, Co. Down, for controlling four three-wire power circuits and one four-wire lighting circuit in their factory.

For controlling individual motors three-phase low-tension no-voltage switches of the types shown in figs. 2, 3 and 4 are employed.

The first two views are of rotary type oil switches, ironclad, adapted for 550-volt 50-cycle circuits, and designed for wall fixing. These switches are of the chopper blade type, spring controlled; a single-phase no-volt non-vibratory coil, fitted in the metal hood on the top of the case, is energised on closing the switch. The armature of the no-volt combination is lifted up by hand and magnetically held by the coil, unless the voltage fails, when it drops, disengaging the spring catch and releasing the switch. The main switch can be opened by the auxiliary tumbler switch mounted on the case, which controls the no-volt circuit.

Fig. 4 shows a straight lift automatic switch; shunt coils are fitted in the head of the switch, which are energised when the switch is "on," and hold up an armature, retaining the switch in the closed position. Should the voltage fail, the switch opens immediately by falling out of the fixed contacts by gravity. Such switches can be provided with an overload tripping device if required.

It may be remarked that "no-volt" switches have not been much used for A.C. motors up to now, although equally as desirable as in the case of a D.C. starter.

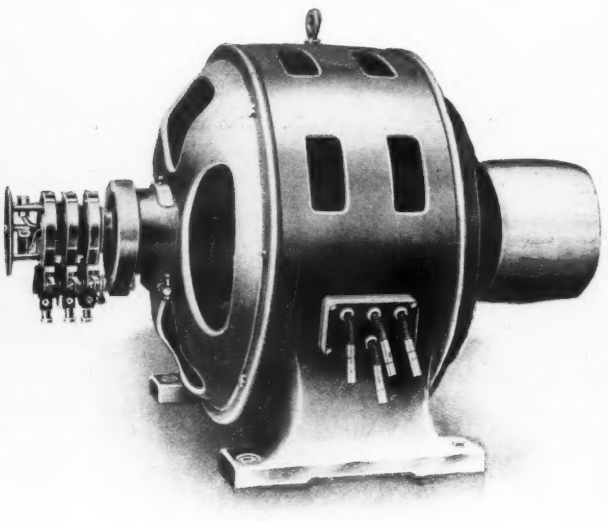
Messrs. Ferranti, of course, make numerous other designs of H.T. ironclad switches for factory work, comprising combinations for single, two and three-phase work, with or without ammeter, and with single, two or three-trip coils for overload and no voltage.

In the case of automatic switches, the firm supply low-tension tripping coils, by preference, fed from small current transformers placed below the main casting carrying the switch.

A reduction gear is provided between the trigger which engages with the main switch lever and tripping mechanism; the oil tanks are of steel, lead coated, and lined and divided with maple wood. The lining is supported so as to leave a free oil space between it and the tank, in order to ensure there being a layer of quiescent oil round the tank at the moment of rupturing a circuit, and thus ensuring sound insulation. Link gear of seasoned and impregnated teak and carefully tested insulators are employed.

Bruce Peebles & Co., Ltd.

A variety of induction motors is made by this firm, in three main types—squirrel-cage, slip-ring, and automatically short-circuited rotor—and these are supplied open, protected, or totally enclosed, as desired; we illustrate one of the protected slip-ring type, in which it will be noticed that the rings are outside the bearing.



Bruce Peebles Protected Slip-Ring Motor.

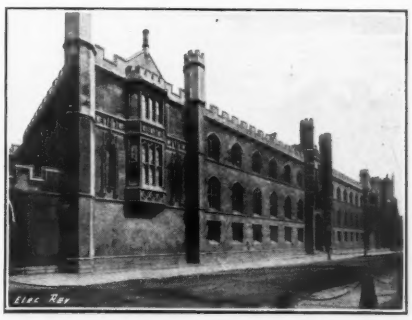
When these motors are used for driving textile machinery, the openings in the frame are covered with perforated sheet steel, in accordance with the recommendations of the Fire Offices Committee, or they can be completely enclosed, and the slip-rings are enclosed in a cast-iron box with inspection windows. The most convenient type to employ is the automatically short-circuited rotor type, which is capable of starting up against a considerable torque without requiring an auto-transformer, and with a moderate starting current; it is started with a star-mesh switch. A special type of motor is also supplied, which is arranged to run at either of two fixed speeds by changing the connections of the winding with suitable switchgear. The bearings are usually of phosphor-bronze, or of cast-iron lined with white metal, according to size, but ball bearings are fitted to the smaller sizes when called for.

Figs. 2 and 3.—Rotary Oil Switches. Fig. 4.—Straight-Lift Switch.

Ferranti Three-Phase Low-Tension Switches.

CONCENTRIC "STANNOS" WIRING AT CAMBRIDGE COLLEGES.

In a recent issue we described the electric lighting of Rossall School, Lancashire, where the wiring had been carried out entirely on the concentric system with Stannos wires, the electric supply being derived from a private plant. It is one of the claims of Messrs. Siemens Bros. & Co., Ltd., that Stannos wires may also be employed with advantage for concentric wiring on an alternating-current public supply, if double-wound transformers are used in



Corpus Christi College, Cambridge.

order to totally disconnect the internal conductors from the supply mains. Installations on this principle are being carried out in various localities, but additional interest is afforded in cases where the buildings are old, the decorations valuable, and the architectural designs elaborate, as Stannos wires are so well adapted to overcome such difficulties.

With the exception of our cathedrals, there are few buildings in this country which answer the above description better than some of the old University Colleges at Cambridge and Oxford. The former town possesses a public alternating-current supply: and therefore when the question of wiring arose recently in connection with St. Mary Magdalene, Corpus Christi and Pembroke Colleges, it was decided to take advantage of this fact to install Stannos wires on the concentric system, as it afforded the best and most inexpensive means of overcoming the antiquarian, æsthetic and architectural difficulties.

The first of the above colleges to take up the question was St. Mary Magdalene. An extension, to the designs of Sir Aston Webb, was in course of erection, and the authorities decided, in conjunction with their architect, to light this part by means of electricity. The matter was placed in the hands of Messrs. Handcock & Dykes, who were also asked to submit a report as to the advisability of installing electric light in the old buildings, where hitherto oil lamps and candles had been employed. Whilst it was a comparatively easy matter to arrange for the wiring of the extension, where it was decided to install the Kalkos draw-through system as the work advanced, much careful thought and consideration had to be given to the old buildings. Owing to the antique and valuable nature of these structures, it was found impossible to install a system of conduits there without cutting away and disfiguring the decorations in the rooms, and it was decided, therefore, to use Stannos wires, as these could easily be run behind the panels and skirtings, and, when on the surface, in the angles formed by mouldings, architraves, &c.

The current is supplied by the Cambridge Electric Supply Co. at a pressure of 200 volts. The company's service has been brought into the porter's lodge by the main entrance, where it is metered and then distributed by means of ·05 sq. in. concentric paper-insulated and lead-covered and armoured cable, laid underground right across the courts, teeing off at several points to 7/18 cables, which are taken to the various staircases, where the pressure is converted by means of double-wound transformers. These are situated in each case on the ground floor of the particular staircase or block that they have to feed. They are of the Foster type, and are absolutely silent in working. The ratio of transformation is 200 to 100 volts, the secondary having a mid-wire tapping in order to give two circuits of 50 volts each. Additional terminals are provided on the secondary side, so that the voltage may be adjusted to compensate for differences in supply pressure and for the voltage drop in the sub-wiring.

The installation throughout is wired on the concentric system, Kalkos tubes in the case of the extension, and the metal sheathing in the case of the Stannos wires in the old buildings serving as the earthed return of a three-wire system. A main switchfuse of the Hope type is fixed alongside each transformer in the primary circuit, so that the transformers can be switched off during the daytime or during vacation, when the light is not required, and thus the no-load losses are saved. A distribution fuseboard of the Blotter type, with a double set of fuses for the two sides of the three-wire system, in a lock-up case with a glass front, is fixed next to each transformer, and from here the various halls and bedrooms, &c., are wired; separate meters have been provided to measure the consumption of energy in the kitchens and other offices, and also in certain of the Fellows' suites of rooms. The sub-circuits consist of 3/20 Stannos wires, which are run from the distribution boards in various directions, with 1/18 Stannos wires looped off to single light and switch points.

The special feature of the wiring is that there are no joints on the whole installation, the wires being looped from point to point. The Stannos wires are fastened between the floors and on the surface of the walls by means of buckle-clips and cushion-clips, and present a very neat appearance where they are at all visible. Alternate rooms have been wired from opposite sides of the three-wire system, so that the current, when the circuits are evenly balanced, passes through the lamps on both sides of the system and back to the distribution board direct, with little or no current returning through the outer sheathing or "neutral." Switches and all other accessories are of the standard kind, and are mounted, in accordance with the Stannos system, on small turned wood blocks with a continuity fixture behind for maintaining the metallic continuity of the metal sheathing. The whole installation is earthed at several points to the water mains. The lighting arrangements are generally fairly simple, so as to be in keeping with the style of the buildings. Each undergraduate's room is fitted with one single-light pendant and one plug point, and each Fellow's room, being somewhat larger, with a three-light pendant and one plug point. More elaborate fittings have been selected for the library and the chapel, which contain some very fine carved panels, screens and mouldings. The library is lighted by means of two six-light antique brass candelabra converted for electric candles, and suspended from the ceiling by means of chains. In this room the Stannos wires are quite out of sight. In the chapel the Stannos wires are run along the top of the moulding, where they are distempered the same colour as the stone; the question of the fittings is not yet settled. For the present the large dining hall, as well as the Pepysian Library, have not been wired for electric light; in the former the College's fine old silver candelabra are still used, and the latter is only open in the daytime.

The Kalkos installation in the new buildings is fed by a 7/18 branch from the main cable. The wires are of the 600-megohm grade, insulated with vulcanised rubber, taped and braided, and this part of the installation does not call for any special comment, with the exception that the whole of the wiring is invisible and the switches are all in Kalkos boxes sunk to the level of the plaster and fitted with flush plates. In all, the installation comprises 259 points, equalling 359 metal-filament 30-watt lamps.

About the same time that St. Mary Magdalene College was being wired, the authorities of Corpus Christi College were considering the question of extending their electric light installation, which, so far, embraced only the Hall and combination rooms, these being already wired on the screwed barrel two-wire system, with a transformer which reduced the pressure from 200 to 50 volts.

As the buildings presented very similar features to those of St. Mary Magdalene College, the authorities asked the consulting engineers to the latter college to advise them in the matter, and were recommended to install the Stannos concentric system, as the most inexpensive and most expedient under the circumstances.

The supply company's service is brought into the porter's lodge, as in the previous case, where, after being metered, it is split into five main circuits; one of these controls the old installation, whilst the others supply the new installation in the following manner:—Three are 7/18 paper-insulated cables for the indoor lighting (two of which run over the courtyard to the various blocks on the other side, and one goes to a distribution fuseboard controlling the block in which the porter's lodge is situated); the remaining one is a special 5-ampere twin cable for the outside lights in the New Court. The transformers, switches, distribution fuseboards and

Chapel of Corpus Christi.

the sub-wiring generally, are of the same pattern, and carried out on the same principle, as in the case of St. Mary Magdalene College, and, therefore, do not need any further description. The same supplies to the wiring of the Undergraduates' and Fellows' rooms.

The chapel of Corpus Christi is one of the largest in Cambridge; but whilst the decorations on the walls are chiefly in stucco, they are fairly elaborate, and necessitate just that careful work for which Stannos is so well adapted. The wall on each side of the chapel is broken up into five bays, by means of four pilasters of hemispherical

scalloped section. A brass corona fitting with five 16-c.p. lamps is mounted about halfway up on each pilaster. These fittings were made in the works of Messrs. Bailey, Grundy & Barrett, to the design of the consulting engineers. The wires are run along on the top of the faience, where they are quite out of sight, and are then taken inside the pilasters and come out again at the back of the corona fittings. In addition to the latter, there are two-light brackets at the entrance end of the chapel, one over each reading desk. The lighting of the altar at the east end is peculiar and interesting. Here the side of the Chapel widens out slightly, and in the right-angles thus formed at each side a strip of Linolite is fixed, containing four tubular lamps; these throw the light at an angle of about 45° direct on to the altar, and produce a very pleasing effect.

It may be mentioned that the dining hall is lighted by means of four converted gas electroliers, each containing 16 50-volt 16 c.p. lamps in two circuits of eight each. The wall at the far end has

Dining Hall, Corpus Christi College.

two three-light brackets. The total number of new points at the Corpus Christi College is 436, equalling 532 metal-filament lamps of 30 watts each.

The whole of the work in both these colleges has been carried out by Messrs. Bailey, Grundy & Barrett, Ltd., electrical contractors, of Cambridge, under the supervision of the consulting engineers. Amongst the many difficulties which they had to overcome was the exceedingly short time which was available in both cases for completing the installations, the work having to be carried out during the vacation. There is no doubt—having in view the fact that the wiring had to be done in such a manner as to cause as little inconvenience as possible to the Fellows and others in residence, and also that the historic value of the buildings had to be considered to such an extent—that the progress which was made with the work could not have been equalled with any other system of wiring.

We understand that this firm of contractors has also just completed, on the same system, Little St. Mary's Church, the number of lights in this being 40.

The third college in which the Stannos concentric system has been used is Pembroke, New Court Buildings, where the work has been carried out by the wiring department of the Cambridge Electric Supply Co., Ltd. The service is brought into the basement, through the company's fuses and meter, and then to a D.P. main switch and two S.P. fuses, and taken to a Berry double-wound transformer of 4,000 watts capacity, where the pressure is reduced from 200 to 50 volts. The secondary terminals are connected to a four-way main distribution board. This board is provided with four fused circuits and one earth link, which is a very convenient arrangement for testing purposes. From this main distribution board three 7/18 paper-insulated, lead-covered and armoured mains are run into and round the courtyard for feeding the various staircases of the new building. There are six of these staircases in all; one of these is fed by a 7/20 Stannos cable, which goes direct from the main fuseboard to the staircase immediately above; two lots are each fed by one 7/18 cable and the sixth by the remaining 7/18 cable. The two mains which each feed two staircases, are provided with joint boxes filled in solid with bitumen, for teeing off to the first staircases. All the staircase mains enter the respective basements, and pass through a receiving box with a fuse and an earthed coupling. From this point a 7/20 Stannos cable rises to a distribution fuseboard on the first floor, and thence it is looped to the second and third floors, a distribution board being fixed at each loop. The staircase sub-mains in five staircases each control six suites of rooms, and one, nine suites, each suite being fitted with three lights and one wall socket. The wiring, which in most cases is brought down outside the rooms to the switches, and run under the floors and pierced through to the fittings, is practically invisible. Generally speaking, the style of fittings and the number of lights are on the same scale as those in the two colleges already described. The wires are all looped from point to point, and not a single joint has been made in the whole building. The staircase lights themselves are fed from the respective fuseboard and controlled by keyless switches. The total number of points in the Pembroke building is 204, equivalent to 136 metal-filament lamps each of 30-watt capacity.

It may be stated that this installation at Pembroke is quite separate from the wiring of the old buildings, which was carried out in the early days by a mixed system of compo. pipe and wood casing, and which is supplied from quite a separate service.

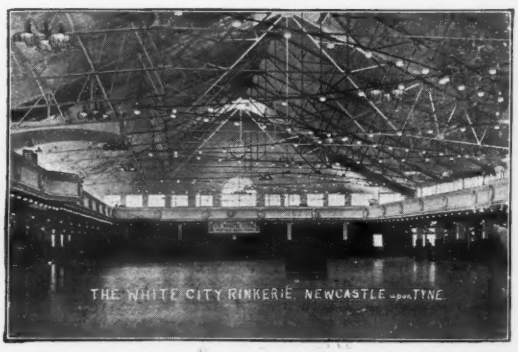
The supply company has also completed an installation of 70 lights in the Master's Lodge of St. Catharine's College, the wiring of which has been carried out on the Stannos system with one side earthed.

In conclusion, we have to congratulate Messrs. Bailey, Grundy and Barrett, Ltd., and the Cambridge Electric Supply Co., Ltd., on their enterprise in boldly taking up a new system of wiring, which promises to tap a source of business that it has previously been almost impossible to acquire; and it is to be hoped that the success which they have achieved will help to give that stimulus to the wiring business in this country, which has been so urgently needed for many years.

A.C. Motors.—Messrs. E. Brook, Ltd., make a speciality of single-phase motors fitted with ball bearings, for which there is a great demand. For textile mills the same type of motor, wound for three-phase supply, is suitable, and Messrs. Brook have already equipped several Yorkshire mills with motors for driving woollen machinery, one mill at present in hand taking 28 motors, with a total power of about 450 H.P. They have also equipped a chemical works with 19 motors, aggregating 420 H.P., and have placed in Huddersfield and the adjoining district 474 motors, of a total output of 2,297 H.P.

Textile Mills in Brazil.—An American vice-consul at Rio de Janeiro states that the largest jute mill in Brazil, which controls the output of the finished product for coffee sacks, operating in the city of Sao Paulo, is adding 5,000 spindles, and by June 1st will have 15,000 spindles in regular operation, making it one of the largest in the world. At present many of the small jute mills in Brazil, which import yarn largely from Scotland, buy none of the Brazilian spun jute, but the increased production from the mill mentioned will undoubtedly decrease the imports of jute yarn for small weave mills. The 10,000 spindles now in use already supply practically all the large mills in Brazil, as well as the 1,500 looms in the two mills owned by the concern that operates the spinning mill. Fabrica Rink, the largest woollen mill in Rio de Janeiro, and the only one of consequence in the district, now operating 1,200 spindles and 104 looms, will shortly put in new installations, bringing the total up to 1,900 spindles and 132 looms. Electrical installations have been ordered, and the factory will be operated entirely by electric power. About the same time an installation will have been put into the only one of the cotton mills of the Federal district which remains to adopt electric motive power. The total installations in the nine mills thus far using electric current amount to about 10,000 H.P.

Newcastle Skating-Rink Lighting.—In our issue of April 1st we gave a brief description of the electric lighting arrangements at the White City Rinkerie, Newcastle-upon-Tyne



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Rink Lighted with Osrams

We learn that the metallic-filament lamps used are Osrams, some 600 in all being supplied. A view of the building, showing the electric light fittings, appears in the accompanying illustration.

CONTRACTS OPEN.

(*Continued from page* 690.)

London.—L.C.C.—May 4th. Wiring and fitting at Fairclough Street and Amberley Road schools. See "Official Notices" April 22nd.

The Highways Committee has recommended that "tenders be invited by advertisement for the supply of 250 electric cars of the bogie-truck double-deck type, fitted with roof covers and draught screens, and other types as required." These will be required in connection with new and reconstructed tramways to be put in hand during 1910-11. The Committee advises that arrangements be now made for this large number as by so doing more favourable prices can be obtained, and loss of traffic through delays will be avoided.

Newport.—May 2nd. 1,000-KW. double-current turbo-generator, or 1,000-KW. turbo-alternator, with surface condenser, for the Corporation. See "Official Notices" April 22nd.

Radcliffe.—May 14th. One 300-KW. continuous-current dynamo, for the U.D.C. Electricity Department. See "Official Notices" to-day.

Spain.—May 14th. The municipal authorities of Salamanca are inviting tenders for the concession for the electric lighting of the town.

Tasmania.—LAUNCESTON.—June 13th: Overhead electric equipment of tramways for municipal authorities. June 27th: Synchronous motor-generators and battery, reversible booster, &c. Tenders in both cases to Mayor and Aldermen, Town Hall. Conditions, &c., from Town Clerk, (one guinea deposit each specification).

Turkey.—May 28th. H.M. Consul at Constantinople (Mr. A. T. Waugh) reports that tenders are invited by the Turkish Ministry of Commerce and Public Works for a concession for the supply to the city of Constantinople of electrical energy. See this column of our issue of April 15th, for fuller particulars.

Uraguay.—July 4th. Twenty electric cranes, 1·5 to 5 tons, for the port of Monte Video Particulars from the Administrative Council of the Port.

War Office.—May 4th. Two electrolytic hydrogen and oxygen producing plants for the South Farnborough Balloon Factory. See "Official Notices" April 15th.

West Bromwich.—May 2nd. 750-KW. D.C. turbo-generator and surface condenser for the Corporation Electricity Department. See "Official Notices" April 15th.

Whitehaven.—May 2nd. Green fuel economiser, feed and other piping, and main switchboard, for the Corporation Electricity Department. See "Official Notices" April 15th.

CLOSED.

Aberdare.—The U.D.C. has accepted the following tenders in connection with the E.L. installation:—

D. Tyssul Davies, Aberdare.—Station, £1,085.
Lancashire Dynamo and Motor Co., Ltd.—Generating plant, £3,312.
Callenders' Cable and Construction Co., Ltd.—Cables, £8,247.

Australia.—FREMANTLE.—In connection with the extensions to the Fremantle (W.A.) tramways generating plant, orders have been placed in this country for a new water-tube boiler and superheater, a 330-KW. two-phase alternator coupled to high speed engine, surface condensing plant, and pipework in connection with the above. The plant is being supervised before shipment on behalf of the Fremantle Tramways and Lighting Board by Mr. Frank Broadbent, M.I.E.E., consulting engineer.

According to the *Australian Mining and Engineering Review*, the P.M.G., Victoria, has ordered from Noyes Bros. (Melbourne) Proprietary, Ltd., the following:—

478,000 insulators, porcelain, pattern B, at 2d. each; 100,000 insulators, porcelain, pattern B, at ½d. each; 16,000 insulators, porcelain, pattern B, at 2 1/16d. each; 35,000 insulators, porcelain, pattern B, at 2 1/16d. each; 5,000 insulators, porcelain, pattern B, at 2½d. each.

Messrs. Dalgety & Co., Ltd., Melbourne, will supply 30,000 pattern A porcelain insulators at 5 3/16d. each.

Davies, Shephard & Co., of South Melbourne, will supply a large number of fuses, Leclanché cells, zincs, pots, &c, and the Standard Cable Manufacturing Co., Ltd., London, many hundreds of miles of tinned copper wire.

For the Queensland department, the Western Electric Co. will supply a lamp-signalling switchboard, at £3,795.

The British Insulated and Helsby Cables and James Paton & Co. have contracts for telephones.

Aylesbury.—The U.D.C. has accepted the tender of Messrs. E. T. Mackrill & Sons, Aylesbury, for electrical work, for a year.

Bedford.—The T.C. has accepted the tender of Messrs. W. H. Allen, Son & Co., Ltd., of Bedford, for a 750-KW. steam alternator, at £3,706.

Belgium.—No fewer than 10 concerns—five German, two French, and one each British, Austrian, and Belgian, competed for the contract for the supply to the Société Nationale des Chemins de Fer Vicinaux of the electric cables required in connection with the lines in the Brussels district. The contract was divided into two parts for one of which the British Insulated and Helsby Cables, Ltd., of London, succeeded in submitting the lowest offer. For the second part of the contract they were underbid by Messrs. Felten & Guilleaume, of Mulheim, and the A.E.G. Union Electrique Co.

Cape Colony (Ceres).—The tender of Messrs. Koch and Dixie, of Cape Town, has been accepted for the installation of a turbine-driven plant for street and private house lighting. The plant will allow of about 70 street lamps, and about 2,000 16-C.P. lights for private consumers.

Derby.—The Midland Railway Co. have decided to extend their electrical generating station at Derby, and have placed an order for two 1,250-KW. Willans "impulse disk and drum" type turbines with Messrs. Willans & Robinson, Ltd.

East Ham.—The T.C. is obtaining from Messrs. Pollock and McNab a motor-driven drilling machine, with motor, &c., for the tramway undertaking, at £84. The tender of Baxter & Caunter, Ltd., has been accepted for the supply of cable to replace that recently destroyed by fire. A quotation from the Patent Railway and General Engineering Co., to affix 100 patent manganese steel plates to the rail joints of the permanent way, has been accepted at 35s. for each joint, exclusive of unskilled labour. Hadfields, Ltd., are to supply manganese steel rails for a double curve at £280.

Glasgow.—The T.C. Committee on Works and Stores has recommended that the following offers be accepted:—

Copper collector brushes.—British Westinghouse Co., Ltd.
Special track work.—Lorain Steel Co.
Brass tubing.—Leslie & Hall.
Tie-bars.—P. & R. Fleming & Co.
Wrought-iron tubes and fittings.—Stewart & Lloyds, Ltd.; D. Richmond and Co., Ltd.
Galvanised wires.—Allan, Whyte & Co.
Tool steel.—Ibbotson Bros. & Co., Ltd.; L. N. Ledingham & Co.
Traction lamps.—W. C. Yuille & Co. (portion).
Copper bonds.—Lahmeyer Electrical Co., Ltd.
Steel tire car wheels.—John Baker & Co., Ltd.
Steel tires.—Brown, Bayley's Steel Works, Ltd.; John Baker & Co., Ltd.
Car axles.—Hurst, Nelson & Co., Ltd.
Iron castings.—Carron Co.; R. Howie & Co.
Malleable castings.—A. Shanks & Sons, Ltd.; Tangyes, Ltd.
Steel castings.—Clydesdale Steel & Foundry Co.
Chilled iron car wheels and brake blocks.—Miller & Co., Ltd.

Gravesend.—In our last week's list of successful meter tenderers, for the name of the Electrical Co., Ltd., read the Electrical Apparatus Co., Ltd.

London.—MARYLEBONE.—The B.C. has accepted tenders for the following for the electricity undertaking:—

W. T. Henley's Telegraph Works, Ltd.—Rubber tubing.
Pryke & Palmer.—Chatterton compound, rubber insertion, strip, tape, &c.
Siemens Bros.—Black adhesive tape, rubber gloves and mats.
Pooley & Austin.—White silesian tape.
Anti-Attrition Metal Co.—Gun-metal copper and brass.
General Electric Co.—Capping.

BATTERSEA.—The B.C. has accepted the tender of Geipel & Co., for the annual supply of carbons.

WOOLWICH.—The B.C. has accepted the tender of Crompton and Co., Ltd., for the supply of "A" type carbons, at £55.

At the meeting of the Council on April 20th, it was reported that the electrical engineer had tendered for installation work, (*a*) at £69 net, work to be carried out by Messrs. C. J. Wilkin & Son, and (*b*) at £93 10s. the work to be carried out by Messrs. Whistler and Worge. It was explained that these amounts will probably be varied while the work is in hand and hire-purchase terms accepted. It was resolved that contracts be sealed with applicants in the event of the Borough Electrical Engineer's tenders being accepted, and that the contracts with Messrs. C. J. Wilkin & Son and Messrs. Whistler & Worge be sealed.

L.C.C.—The Highways Committee received tenders as follows for the machine-shop equipment for the second section of the central car-repair depôt:—

Buck & Hickman, Ltd.	(accepted)	£2,949 (Tangye lathes)
" "		£3,015 (Parkinson lathes)
Tangyes, Ltd.		£3,020
H. W. Kearns & Co., Ltd.		3,224
Dempster, Moore & Co., Ltd.		3,460
Pollock & MacNab, Ltd.	(Not to specification)	2,143
H. W. Ward & Co., Ltd.	(Tender incomplete)	976
J. Parkinson & Son, Shipley	" "	647

Estimate of chief officer, £3,000.

The following tenders were received from selected firms for electricity watt-hour meters for the central car-repair depôt, car-sheds, and sub-stations:—

Electrical Co., Ltd.		£364
Electrical Co., Ltd. (alternative tender)	(accepted)	390
Bat Meter Co., Ltd.		372
British Thomson-Houston Co.		423
General Electric Co., Ltd.		451
Ferranti, Ltd.		545
British Westinghouse Electric and Mfg. Co. (incomplete tender)		168
Chamberlain & Hookham, Ltd.	(incomplete tender	177

Messrs. Edgar Allen & Co., Ltd., are to supply a stone-crushing machine, screen and elevator for the Battersea Bridge permanent-way tramway depôt, at £205.

Salford.—The Education Committee has accepted the tender of the Northern Electrical Co., of Manchester, for installing the E.L. at Wellington Street schools, at £134.

For the ninth successive year the Lancashire Dynamo and Motor Co., Ltd., have received the contract for high and low-speed motors, 25—50 H.P. for the Corporation.

Smethwick.—The Education Committee has accepted the tender of Best & Lloyd, for E L. fittings, &c., for the Technical School, at £128, and that of Mr. Ludlow for wiring work, at £80.

West Ham.—The T.C. has accepted the following tenders for electrical supplies:—

House service A.C. wattmeters.—British Thomson-Houston Co. (new type of meter).
House service cut-out boxes.—Lucy & Co.
India-rubber covered wires and cables.—Messrs. Pirelli (six months with option of extending for a further six months).
Electrical accessories.—Baxter & Caunter; British Electrical Manufacturing Co.; Feld Bros. & Co.; Tucker & Co.; Falk, Stadelmann & Co.; The General Electric Co.; Edison & Swan Co.; Siemens Bros. Dynamo Works; British Westinghouse Co.; Siemens Bros. & Co.; E. Dewhurst; W. T. Glover & Co.; Accles & Pollock.

The T.C. has accepted the tender of Blakeborough & Sons, at £486, for circulating water piping.

FORTHCOMING EVENTS.

Institution of Civil Engineers.—Friday, April 29th. Students' visit to Southampton Docks and Messrs. Harland & Wolff's engineering shops.

Institution of Mining Electrical Engineers (South Wales Branch).—Saturday, April 30th. At 5 p.m. At Baring's Hotel, Cardiff. First annual dinner. Paper on "Colliery Cables," by Mr. N. J. Richards.

Institution of Electrical Engineers (Students' Section).—Wednesday, May 4th. At 7.45 p.m. At 92, Victoria Street, S.W. Annual general meeting.

Röntgen Society.—Thursday, May 5th. At 8.15 p.m. At 20, Hanover Square, W. Paper on "Quantitative Measurements of the Conversion of Kathode Rays into Röntgen Rays by Anti-kathodes of Different Metals," by Mr. J. H. Gardner.

Institution of Electrical Engineers (London).—Thursday, May 5th. At 8 p.m. At the Royal Society of Arts. Paper on "A Telephone Relay," by Mr. S. G. Brown.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

The following orders are announced:—

Commanding Officer—Col. R. E. B. Crompton, C.B.

Monday, May 2nd.—"A" Company. Recruits' infantry drill, 6 to 6.45 p.m.; company drill, 7 to 9.30 p.m.
Tuesday, May 3rd.—"B" Company. Company drill, 7 to 9.30 p.m.
Wednesday, May 4th.—Gymnasium, 6 to 9.30 p.m.
Thursday, 5th.—"C" Company. Recruits' infantry drill, 6 to 6.45 p.m.; company drill, 7 to 8 p.m.; technical drill, 8 to 9.30 p.m.
Friday, May 6th.—"D" Company. Company drill, 7 to 8.30 p.m.; technical drill, 8.45 to 9.45 p.m.
Saturday, May 7th.—"D" Company. Company drill, 3.15 to 4.15 p.m.

(Signed) P. H. Campbell, Capt. R.E., Adjutant.
For O.C. E.E., L.D.

NOTES.

"Tantalum" Athletic Club Concert.—The first annual concert of the "Tantalum" Athletic Club connected with Messrs. Siemens Bros.' Dalston Works, was held on Monday evening, when a highly interesting programme was arranged. The Assembly Hall of the Dalston Central Mission was requisitioned, that being the only building within easy radius of the works in which such a large audience could be accommodated. The hall was illuminated by "Tantalum" and "Onewatt" lamps. The proceedings were confined to the employés of the firm, and there was a good muster. The talent also was entirely from the works staff. A novel feature of the affair was a singing competition, open to all employés of the firm, for which prizes were offered, the audience acting as judge. The first prize went to Mr. Rogers, the second to Mr. Lewis, and the third to Mr. Hopper, jun. The proceeds went to strengthen the war chest of the newly-formed "Tantalum" Athletic Club.

Electric Steel.—The first of several electric steel furnaces, says the *Electrical World*, has been installed in the Delicias rolling mills in the city of Mexico, owned by Richard Honey.

The Lithgow Small Arms Factory Electrical Contract.—Papers continue to reach us from Australia showing how deep and widespread is the feeling among those connected with the electrical trade in New South Wales at the unfair manner in which the above contract was dealt with (see Electrical Review, April 8th, page 538). One of these reports states that on March 23rd at a general meeting of the Electrical Employers' Association of New South Wales, held in the rooms of the Employers' Federation last night, the question was again brought forward for discussion. The chairman, Mr. E. J. Erskine, in reading the business paper before the meeting, said in reference to the attitude which the Association was taking:—

"This afternoon this matter was placed before the Employers' Federation. I have asked it to assist us, as we are too small a body, and are too tender, to insist on the Government doing anything. We are determined, however, that the Government shall come out and tell us its reasons for its actions in this matter. The Employers' Federation, I believe, will take a stand in our favour so far as the State Government is concerned. A deputation or petition will be arranged. We will then go fully into the matter of the State departments calling for tenders. We shall insist that the State Government's requirements shall be secured by tender from all the firms, and not from one. If we want to take the matter up with the Federal Government, I understand that the right people to do it are a Melbourne association. There is also a likelihood that the Manufacturers' Association will help us so that, with this assistance, I feel certain that we shall eventually compel the State Government in the future to give everyone a fair deal."

A motion was carried confirming the action which the Committee had taken in connection with the small arms factory.

For Sale.—Particulars appear in our advertisement pages of a sale by tender at Leicester of the bankrupt stock of an electrical contractor.

Messrs. Percy Huddleston & Co. have been instructed to sell by auction at Bristol on May 10th a large quantity of electrical apparatus. For further particulars see our advertisement pages.

Electricity Supply in Great Britain.—Our contemporary, the *Electrical World*, commenting on the new Electricity Supply Act, falls into the error of supposing that in future "no person will be allowed to supply electricity in Great Britain except in accordance with statutory powers." This applies only to areas where another undertaker already possesses statutory powers. Where such powers exist, a monopoly is practically created by the new Act, but where no such powers exist there is no restriction upon the supply of electricity by private persons without statutory powers.

The Railways of Chile.—In connection with the announcement of the Chilean Government's intention to proceed with the electrification of 156 miles of railway, it is of interest to read that the contract for the construction of the northern section of the Chilean Longitudinal Railway, which has been awarded to the representative of a British banking syndicate, has been competed for by several other British and American interests. It is expected that the work will be finished in four years' time. This railway, when completed, will run from north to south—from Arica to Santiago de Chile—a distance of 1,501 miles, and will form a junction with the proposed Pan-American Railway, and thus bring Santiago and New York within a 10,000-mile railway journey of each other. Our readers will probably remember an article by Mr. C. A. Smith, of Santiago, which appeared in our issue of November 19th, 1909, entitled "Railway Electrification in Chile." The report of Mr. James McKerlie, A.M.I.E.E., A.M.I.Mech.E., and the proposal of the Italian Westinghouse Co., were there summarised.

An American Consular note recently to hand, alluding to German activity in Chile, says that it is reported from Valparaiso that "an experienced German railway man has been engaged for a period of three years as Director-General of the Chilean State Railways. No doubt German railway supplies will be in evidence during that time. German interests are making great efforts for the business of Chile, with good results. From the best information obtainable at this time Germany supplied a greater percentage of the imports for 1909 than for any previous year, and the outlook for German interests seems brighter than ever before."

Brussels Exhibition Opened.—King Albert, accompanied by Queen Elizabeth, opened the Brussels International Exhibition on Saturday last. Our daily papers have been full of praise for the British display, which, thanks to the Governmental assistance already fully alluded to in these pages, and to the Exhibitions Department of the Board of Trade, of which Mr. U. F. Wintour is the chief, is said to be a credit to Great Britain and to those who have organised the exhibit.

Electric Power in Formosa and Java.—In the *A.E.G. Zeitung* for April an account is given of a hydroelectric installation carried out by the Allgemeine Elektrizitäts Gesellschaft at Ronokei, Formosa. The plant consists of four three-phase generators of 400 KW. output at 0·8 power factor, 60 cycles, 600 R.P.M., driven by Francis turbines, working under a head of 21·3 m. Power is transmitted at 33,000 volts to Nanshiko, where the line bifurcates, supplying the towns of Tainan and Takao on the coast, the distance traversed being some 40 km.

In the same issue there is a brief description of several installations carried out by the A.E.G. in Java, in which Diesel engines are used as prime movers, the largest sets being of 600 H.P. each. Water-power is also employed, with Pelton wheels of 600 H.P. each, and power is transmitted at 30,000 volts.

Electrical Bleaching.—There has been an increasing amount of interest shown of late in electrical bleaching, and the reports of manufacturers of the apparatus show that there is a steadily increasing demand for the same. Practically the whole of the apparatus sold is used on the Continent, English bleachers, &c., still looking upon the electrical process with suspicion and mistrust; but the introduction of the apparatus into English factories and mills can, of course, only be a question of time, and that time is probably not very remote. There are various forms of electrolysers on the market, all operating on the same principle, but differing in details of construction; the detail which presents the most difficulty in designing the cells is the electrode. The substance most generally employed nowadays is carbon, which has the advantage over other possible materials that it is cheaper in the first instance. That, however, is all that can be said for it. In one of the best-known electrolysers platinum-iridium is employed. The electrodes in this apparatus are constructed in the form of a fine wire net, so that a minimum amount of the metal is made to cover a large area. Of course, these electrodes are somewhat more expensive than those of carbon in first cost, but they last practically for ever and do not depreciate in value.

As to the working costs of the electrical process, these depend principally upon the cost of the energy, and with electricity at anything less than ½d. per unit, the electrical bleach is cheaper than bleaching powder. As the electrolysers are usually arranged to run day and night, and as they consume a practically constant amount of energy, they form an ideal load for the station, and can be installed in some cases without increasing the existing generating plant.

Electric Disinfectant at Poplar.—On Tuesday, the 19th inst., the members of the Faraday Society were invited to inspect the additions and improvements which have been made to the plant installed by the Borough Council for the manufacture of electrolytic disinfectant. The first section of the plant was set to work in February, 1906, and at the time was fully described in our pages. The essence of the process is the electrolysis of a mixture of saturated solutions of sodium chloride (common salt) and magnesium chloride. This action takes place during the passage of the solution past electrodes of zinc and platinum between which a current of electricity is flowing. The E.M.F. required per pair of electrodes is about 5 volts, and the original plant consisted of 40 sets of electrodes placed in series across the 240-volt direct-current public supply mains, taking during action from 10 to 15 amperes.

The new plant consists of a duplicate set of electrodes supplied with liquid from the same tank, and is intended for placing across the other side of the supply mains. In the old plant the electrodes were placed in slate troughs—10 sets in each of the four troughs—and considerable trouble was experienced from leakage. This has been overcome by the use of earthenware troughs divided longitudinally, so that five pairs of electrodes are placed in each division.

Another alteration which has been made in the working of the plant since its installation has been the addition of magnesium hydrate in place of caustic soda to the electrolysed fluid. This is thoroughly well mixed with the liquid by means of flapper stirrers worked by a small electric motor, and the final fluid keeps practically unaltered in composition for months.

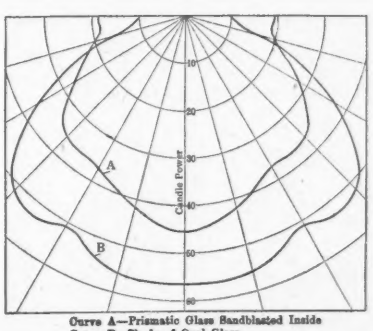
Its active elements are the magnesium and sodium hypochlorites, which are at once decomposed in presence of organic matter, liberating chlorine, which, in its nascent state, is one of the most powerful disinfectants and sterilisers known. The fluid, as usually made, is capable of liberating, in presence of organic matter, from 4 to 5 grammes of free chlorine per litre. During the past year some interesting experiments have been made in the direction of using the fluid to improve the condition of the water in the public swimming baths of the borough. One gallon of disinfectant per 1,000 gallons of water, added at intervals, was found to be ample to effect a marked improvement in the state of the bath, so much so, as to earn the unsolicited commendation of those who were in the habit of constantly using it, while bacteriological analysis showed that the dangerous disease germs so often present were thoroughly destroyed. The financial results at Poplar continue to be so good that it can only be a question of time before other places will copy so excellent an example.

According to a recent report, the cost of the first plant, together with the supply of carboys and the cost of repairs and renewals, from February, 1906, to August, 1909, a period of 3½ years, was £669 8s. 3d., and the cost of the new plant which brings up the capacity to a total of 400 gallons per day of eight working hours, £450, or a total outlay of about £1,120. During the same period of 3½ years the total quantity of fluid made was 78,660 gallons, and the quantity of electricity used was 12,409 units, for which the sum of 1½d. per unit was paid. The total cost of materials, energy and labour at the Violet Street depôt, where the material was made, was £334 12s. 7d.; materials and energy, costing about half, or £157 1s. 7d., practically ½d. per gallon of fluid. The cost of providing bottles, corks and labels for the supply was £218 11s. 6d., and the cost of labour for distributing at the seven depôts was £238 1s. The total cost of working over the whole 3½ years was, therefore, £791 5s. 1d., or an average of about £226 per year, comparing with an average outlay by the Public Health Department and Guardians for the three preceding years of nearly £950. There is no doubt that great credit is due to Dr. Alexander, the Medical Officer of Health, to whose exertions and perseverance the success of the experiment is almost entirely due.

Montefiore Prize Competition, 1911.—The Association of Electrical Engineers trained at the Montefiore Electrotechnical Institute, Liége, has sent us particulars of the triennial prize competition founded by the late president of the Institution, George Montefiore. The competition is international, and the first award will be made next year for the best original work submitted upon the advancement of science and upon progress in the technical applications of electricity in all branches. The value of the prize in 1911 will be 20,000 fr. (say, £800). Particulars of the conditions can be obtained from the secretary of the Fondation George Montefiore, rue St. Gilles, 31, Liége, Belgium. The competition will be open until March 31st, 1911, and the essays must be written in either French or English.

Electricity in Agriculture.—Mr. J. H. Priestley, B.Sc., F.L.S., of the Department of Economic Biology of the University of Bristol, contributes to this month's journal of the Board of Agriculture an article dealing with the effect upon plant growth of the overhead electrical discharges. Mr. Priestley has been associated with the experiments on this subject carried out at Bitton, Gloucester, and on a large scale at Evesham by Mr. J. E. Newman, in co-operation with Sir Oliver Lodge and his son, Mr. Lionel Lodge. Mr. Priestley's own experiments lead him to attach importance to the acceleration of growth caused by the electrical influence, and he suggests that an increased yield may in some cases be largely due to the fact that the crop is spared bad weather owing to its more rapid development, and its being, therefore, harvested under better conditions. Several indications point to the electricity increasing the vitality of the plant, but as one effect is the giving-off of more water, growth may suffer if the season is exceptionally dry. Some evidence suggests that electrified plants may have greater powers to resist disease. While there have been occasional exceptions, the electrical treatment, as a rule, has been followed by larger and sometimes earlier crops.

On Diffusing Shades.*—The writer had occasion not long ago to make a careful distribution curve from a medium angle opal glass shade intended for use with tungsten lamps. The result obtained was so satisfactory as to encourage going a little further with the matter and comparing the curve thus obtained with that given by a prismatic glass shade with a diffusing coating, producing much the same softening of light as would be obtained from the opal glass. Check readings were, therefore, taken upon a prismatic glass shade, given a diffusing surface by sand blasting inside. Both shades were suitable for the 60-watt tungsten lamp, and were tested with the same lamp. Curve A shows the result with sand-blasted prismatic glass, and curve B with the opal glass. A glance shows that for the purpose of a medium-angle diffusing shade the opal glass compares very favourably with the sand-blasted prismatic glass. The latter let through near the horizontal plane fully twice as much light as the opal glass, but it was not nearly as efficient in turning the light downward through the requisite moderate angle. The sand blasting evidently constitutes a coating much too dense



Curve A—Prismatic Glass Sandblasted Inside
Curve B—Shade of Opal Glass

for the purpose intended, and it blocks off a needless amount of light in the directions where it ought to be sent. The comparison must not be considered as in any sense a severe reflection on prismatic glass with a diffusing surface, but it shows very clearly that the diffusing surface must be very much less coarse than sand blasting to produce first-class results, and it also shows that a good opal glass makes a very excellent diffusing reflector for moderate angles, quite as satisfactory as anything else yet discovered. Curve B, in fact, shows a remarkably good medium angle distribution. It is not an easy matter to produce a diffusing shade, even of a favourable angle like this, of such a character that it shall really meet practical requirements. Unless the diffusing coating given prismatic glass be very filmy and tenuous, it is certain to alter the distribution of the prisms very radically, and if the diffusing surface be too dense, as in this case, the efficiency of the distribution is seriously affected. On the other hand, there are very great differences between different samples of opal glass. The one here tested was particularly good, while others similarly tested have been extremely unsatisfactory, either letting through too much light or not enough.

* Dr. Louis Bell, in the *Electrical World*.

Electrical Treatment of Cancer.—According to the *Electrical World*, Dr. Eugène Doyen claims to have discovered that cancerous cells are destroyed by a temperature of 50-55° C., which is harmless to healthy cells, and that all lesions which are accessible to an electric current can be treated by this means.

Institution and Lecture Notes.—The Tramways and Light Railways Association.—The arrangements for the Tramway Congress that is to be held in Dublin on May 12th and 13th are announced in the April issue of the Association's *Official Circular*. The headquarters will be at the Imperial Hotel, Lower Sackville Street. There will be on the morning of May 12th a reception by Mr. W. M. Murphy and Mr. Wm. Anderson, of the Dublin United Tramways Co., Ltd., and the following papers will come forward for consideration:—

"Short History of the Dublin U.T. Co.," by Mr. R. S. Tresilian, Secretary.
"Should the Act of 1870 be Revised?" by Mr. F. Coutts (Paisley District Tramways Co.).
"Railless Traction," by Mr. Harry England (Wakefield and District Light Railways Co.).
"Standardisation of Brake Blocks," by Mr. J. A. Panton (Liverpool Overhead Railway).
"Tramway Economics," by Mr. J. R. Salter (Lancashire United Tramways, Ltd.).

Friday will be devoted to visits to the tramway power house, &c., trips to Dalkey, and so on.

Institution of Electrical Engineers (Manchester Students).—The annual meeting of the Students' Section was held on Tuesday evening April 19th, at the School of Technology, Mr. C. F. Smith in the chair. The Section now comprises close upon 300 members.

American Society of Mechanical Engineers.—The Spring Meeting will be held at Atlantic City, N.J., May 31st—June 3rd, 1910. The professional sessions will include a meeting on Machine Construction and Operation; a miscellaneous session, on "The Mechanical Engineer and the Textile Industry, &c.," a gas power session, at which reports will be discussed and papers presented on "Gas Engine Generators," "A Regenerator Cycle for Gas Engines using Sub-Adiabatic Expansion," and "Some Operating Experiences with a Blast Furnace Gas Power Plant"; and a Power Transmission Meeting, with papers on "Improvements in Line-shaft Hangers and Bearings," "Friction Clutch Couplings," "Absorption Dynamometer," and "Critical Speed Calculations."

Institution of Electrical Engineers.—At the meeting last week, Mr. W. A. Chamen proposed that Mr. H. Faraday Proctor's name be added to the list of nominations for the Council, which we published in our last issue, and the necessary support being forthcoming, this will be done.

Electric Shock Fatalities.—At an inquest at Whitley Bay on 19th inst. on the body of Alphonse Edgar Dodgson, aged 5 years, the jury returned a verdict of "Found dead on the railway, having been electrocuted while trespassing." It was stated that the boy with his companion, who was found injured, crossed a field, climbed over some wooden railings and got through the fence. While on the line the boys pushed each other about and then they fell on the live rail.

Coroner C. E. Cadle conducted an inquiry on the 20th inst. into the circumstances attending the death of Walter Pattison Liddell (31), of 22, Chester Street, Grasswell, Newbottle, in the employ of Messrs. G. Wardropper & Son, contractors, Penshaw, as a joiner, who met his death at the Philadelphia electric power station belonging to the Durham Collieries Supply Co., whilst following his employment there. Percival Henry Archbald, junior electrical engineer, said he was in a switch chamber at the station when deceased made a wedge for him. Deceased twice handed witness the wedge. The last time there was a flash, and he saw Liddell drop to the floor. Witness did not see him touch either of the three conductors. Witness had been told to keep an eye upon Liddell, because there was danger of which deceased would know nothing, having no expert knowledge. John Stephen Wade, another junior electrician, said he walked into the chamber when he saw a flash. Deceased was standing on a box, leaning against the metal casing, with his arm around the back of the conductor on the right. He at once collapsed. Ferdinand Fawcett Pyle, engineer-in-charge, said he examined the chamber after the accident, and found a slight burn on the tape of one of the conductors, where a breakdown in the insulation had occurred. Witness had told deceased distinctly not to touch anything coloured yellow like the tape. A verdict of "Accidental death" was returned.

Copper.—The mid-monthly circular from Messrs. Merton and Co. again shows a slight falling-off in European visible supplies, which are now 110,220 tons, against 111,432 tons for the end of March, a decrease of 1,212 tons. This is at a slightly higher rate of falling off than for March, when the drop for the whole month was 2,023 tons. Supplies from North America are low, totalling for Europe 9,001 tons for the half month, the average for the 12 preceding months being 26,650 tons per month. Spain and Portugal are slightly better, Chile up to average, Australia low. The deliveries exceed supplies by 1,212 tons. Decrease in stocks is traceable to Liverpool and Swansea, 682 tons, English standard at the same ports and Port Talbot, 205 tons; London, Newcastle-on-Tyne and Birmingham, 1,254 tons. The decrease in English ports is thus 2,141 tons, while the French ports have increased 154 tons. The stocks carried by English ports are to those in France as 13·5 to 1. Afloat from Australia and Chile figures are slightly better, exceeding those for end of March by 775 tons.

Canadian Metallurgical Experiments.—The Canadian Government has appropriated £10,000 for experiments in electric smelting and in research work calculated to stimulate the development of the zinc industry. Dr. Eugene Haanel, superintendent of mines for the Government of Ottawa, will be in charge of the work.—*Electrical World.*

Appointment Vacant.—Superintendent of hired motor and testing department for Salford electricity works (£120). See "Official Notices" to-day.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the Electrical Review *posted as to their movements.*

Central Station Officials.—The following appointments have been made in connection with the West Ham electricity undertaking:—Mr. F. J. Delves, motor superintendent, in place of Mr. T. O. Wilton, resigned; Mr. J. Inglis, assistant motor superintendent, in place of Mr. W. L. Wreford, resigned; Mr. J. Turtle, lighting superintendent, in place of Mr. A. S. Tong, resigned; Mr. E. E. Smith, as canvasser, in place of Mr. E. A. Broom, resigned.

At the Weymouth borough electricity works on Monday afternoon, Mr. H. F. Payne was presented by the employés with a silver cigarette case. Mr. J. H. Bolam, the borough electrical engineer, made the presentation. Mr. Payne is leaving Weymouth to take up a position with the Carlisle Corporation electricity department.

The staff of the Leyton Electricity Works have presented marble timepieces to Mr. W. A. Jones and Mr. J. W. Gibbins, members of the staff, on their marriages.

Mr. G. B. Davies, A.M.I.E.E., has been presented with a Thermos flask, and his wife with a locket chain, from the staff of the West Hartlepool Corporation Electricity Department, on the occasion of their departure for Canada.

Tramway Officials.—Mr. J. Frederic Jones, chief engineer and joint manager Madras electric tramways, has been granted six months' holiday, and expects to arrive in London about the middle of May.

The sub-stations' staff of the London County Council tramways have presented Mr. N. S. Snelling with a case of pipes, on the occasion of his leaving to take up a position with mining engineers in Johannesburg.

General.—On Friday the 22nd inst., Mr. Edward Marett, chief of the submarine cable department at the British School of Telegraphy, Ltd., was presented by the staff and students, with a travelling bag, on his retirement, he having accepted an appointment with the Pacific Cable Board. The manager, Mr. Arthur W. Ward, in making the presentation, stated on behalf of the directors, as well as himself, that they regretted the loss of his services.

NEW COMPANIES REGISTERED.

Hill, Harding & Co., Ltd. (108,926).—This company was registered on April 15th, with a capital of £1,000 in 950 preferred ordinary shares of £1 each and 1,000 deferred shares of 1s. each, to carry on the business of optical, electrical and surgical instrument manufacturers carried on by H. W. Hill, W. G. Harding and H. W. Chapman, at 40, Laitwood Road, Balham, and at Shandon Road, Clapham Park, S.W., as "Hill, Harding & Co.," together with a certain invention for an improved device for controlling an auxiliary electric circuit requiring a voltage which is lower than that of the source of electrical supply. The subscribers (with one preferred share each) are:—H. W. Hill, 49, Laitwood Road, Balham, S.W., electrical engineer; H. W. Chapman, 51, Dornton Road, Balham, S.W., electrical engineer; W. G. Harding, 55, Elmfield Road, Balham, S.W., electrical engineer. Private company. The number of directors is not to be less than three or more than five; the first are H. W. Hill (life director), H. W. Chapman and W. G. Harding; qualification, £50 preferred ordinary shares; remuneration as fixed by the company. Registered office, Shandon Road, Clapham Park, S.W.

Electrical Trust, Ltd. (108,846).—This company was registered on April 14th, with a capital of £2,500 in 2,000 ordinary shares of £1 each, and 10,000 founders' shares of 1s. each, to carry on the business of electrical, telegraph, telephone and mechanical engineers, cable makers, dealers in electrical and other motors, generators and accumulators, &c. The subscribers (with one share each) are:—W. T. Saunders, 185, Fordwych Road, Cricklewood, N.W., mining engineer; W. Lee, 57, Rusthall Avenue, Chiswick, land agent; S. F. Wall, 6, Crosby Square, E.C., merchant; A. J. Needham, 18, Midland Terrace, Cricklewood, N.W., clerk. Private company. The number of directors is not to be less than two or more than four; the first are J. Metcalfe and A. C. Vincent; qualification, £100. Registered office, 9 and 10, Pancras Lane, E.C.

Nu-Ads, Ltd. (108,858).—This company was registered on April 14th, with a capital of £2,000 in £1 shares, to take over certain patent rights from F. J. Blaxley, C. C. Chapman, A. C. Harris and F. H. Blaxley, to carry on the business of manufacturers of and dealers in electric advertising signs, &c. The subscribers (with one share each) are:—F. J. Blaxley, 34, Portland Road, Leicester, solicitor; A. C. Harris, 42, Howard Road, Leicester, scientific engineer. Private company. The number of directors is not to be more than four; first are F. J. Blaxley (managing director) and A. C. Harris; qualification, £100. Registered by Jordan & Sons, Ltd., 116-117, Chancery Lane, W.C.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Delhi Electric Tramways and Lighting Corporation, Ltd. (88,758).—Issue on November 9th of £7,500, on February 9th of £100, and on March 7th of £300 debentures, parts of a series of which particulars have already been filed.

C. F. Casella & Co., Ltd. (106,869).—Issue on April 4th of £350 debentures, part of a series of which particulars have already been filed.

R. J. Rodd, Ltd.—Particulars of £225 debentures created March 23rd, 1910, filed pursuant to Sec. 93 (3) of Companies' (Consolidation) Act, 1908, the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital. No trustees.

CITY NOTES.

Craigpark Electric Cable Co., Ltd.

In their report for the year ended March 31st, 1910, the directors submit accounts showing a net profit of £6,244, which, with the balance of £477 brought forward, makes £6,721. The directors now recommend the following appropriations:—Depreciation written off buildings and machinery, £500; reserve account, £500; dividend on 37,500 6 per cent. preference shares for the year, £2,250; dividend on 37,500 ordinary shares at 6 per cent. for the 12 months ending March 31st, 1910, £2,250; balance carried forward (subject to payment of directors' fees for the past year, £1,221. During the year the company's business has continued to extend. The result, however, has not been so satisfactory as could be desired, due to the great increase in the price of raw rubber. For the greater part of the year it was not possible to realise a corresponding increase in the price of manufactured goods, and this accounts for the diminished profit. Prices of the company's manufactures have been advanced, and business is now on a more profitable basis. The stocks have been carefully gone over and certified by the managing director. The directors regret the death of Mr. W. R. Dick, who had been a director from the beginning of the company, and who took an active interest in its affairs. Mr. Peter Rintoul, C.A., has been appointed to fill the vacancy.

Underground Electric Railways Co. of London, Ltd.

The Right. Hon. Sir Edgar Speyer, Bart. (chairman), presided on Thursday last week, at the offices, Broadway, Westminster, over the ninth ordinary general meeting of the above company.

In moving the adoption of the report (see Electrical Review, page 525), the Chairman said the company was now free of floating debt, while the net revenue for the half-year not only showed a substantial improvement, but was sufficient to pay the full half-year's interest on the 4½ per cent. bonds. The good results obtained were chiefly due to savings in coal consumption and other reductions in the cost of working the Chelsea power station, to their providing a quick and efficient service, and to advertising information regarding the travelling facilities which the system offered. The affiliated companies carried 217,730,081 passengers in 1909, of which the three Tubes carried 95,126,973, the District Railway 66,852,301, and the tramways 55,750,807. This would make them realise what an important contribution to the traffic problem of London they were making. The general traffic conditions in London remained unsatisfactory, and, owing to severe competition, the Tube Companies had been obliged to reduce fares in several instances. The result had justified this policy, but the return was necessarily small. Sir George Gibb had dealt fully with the three Tube Companies at their half-yearly meetings. All the lines were being kept up to a high standard, while the amount placed to reserve by the three Tubes in 1909 was £19,500. He much regretted that, owing to the opposition of the adjoining ground owners, the extension scheme of the Charing Cross Tube to link up with the Bakerloo and District at the Embankment Station was rejected by the House of Lords Committee. This junction would have been a very important one and would have been of great convenience to the public, and he could not but believe that such an important traffic improvement would, in some shape or other, obtain the sanction of Parliament at no distant date. As regarded the Amalgamation Bill now before Parliament, Sir George had dealt so fully and so ably with the reasons for, and merits of, this proposal, that it only remained for him to endorse his statement. To amalgamate the three non-competitive Tube Companies was not an ordinary case of railway amalgamation, but was, as had been well said by one financial paper, purely a measure of financial common-sense. It was urged on the grounds of administrative economy and more efficient working, and was based on the Stock Market experience that one large consolidated stock stood better than three smaller ones. He might be permitted to add that, as an investor, he should prefer the debenture of a company owning 21 miles to the debenture of one owning six miles, even though the latter's surplus for the time being was larger in proportion. In his opinion, the consolidated debentures were the better security. No one acquainted with the experience of the Underground Electric Railways who studied the conditions proposed, could doubt that the policy of amalgamation was the right one, and that the terms were fair and equitable. Mr. Chapman's agreement having terminated, and his task having been accomplished, he had returned to America. The company owed to Mr. Chapman's engineering skill and untiring energy, as well as to his unfailing loyalty, a deep debt of gratitude. The Chelsea Power Station was entirely due to his initiative, courage and ability. The District Railway continued to show encouraging progress, and during the past half-year had paid the full 4 per cent. rate on the guaranteed stock, besides placing to reserve during the year the sum of £20,000. During the present half-year the District continued to improve on these good showings. He was glad to record the practically unanimous vote of the District guaranteed and preference shareholders, represented at the various meetings, in favour of the Bill now before Parliament to empower the company to capitalise the arrears of dividend on the guaranteed stock, and to reduce the dividend on the first preference stock. The terms proposed therein represented a fair compromise between the various security holders. The Underground Co., as holders of the second preference stock, readily acquiesced in the proposed arrangement, but, having regard to the serious losses this company made in the past by taking junior stocks in payment for the heavy cost of electrification, they could not consent to any scheme which would increase the charges ahead of their stock, and thereby postpone further a return on the capital representing actual cash outlay. As stated in the report, the appointment of their general manager, Mr. A. H. Stanley, as managing director of the London United Tramways, would mean unification of management and the spreading of their organisation over this system. They confidently expected that by this means better results would be obtained. The policy of building up a reserve for renewals, foreshadowed in the London United Tramways report just issued, was fully approved by the Underground Co. Let him say, in conclusion, that the results obtained this year justified the hope that as far as the Underground Co. was concerned, the period of deficits was at an end, and that they might now look forward with some degree of confidence to the probability that the income bondholders might now regard some small distribution on their bonds as a not unlikely contingency in the not distant future.

Lord George Hamilton seconded the motion and the adoption of the report, and it was carried without discussion.

The retiring directors and auditors having been re-elected, the meeting closed with a vote of thanks to the chairman.

South Wales Electrical Power Distribution Co.

Mr. W. Gascoyne Dalziel presided over the eighth annual meeting of this company at the Park Hotel, Cardiff, on Tuesday, and, in moving the adoption of the report (see Electrical Review, page 560), said that for the first time in the history of the company there was not a loss on the year's working. The Treforest company, with which they had a working arrangement, had made steady and sure progress. The output had increased from 7,645,125 units in 1908 to 9,833,038 units in 1909, and the cost of generating had been very materially reduced, as shown by the fact that whereas the amount of extra charge levied on the Treforest consumers to meet current expenses during the first half of the year averaged 32½ per cent. above the Mers scale, during the last half of the year it was down to 11 per cent., and, in fact, in December the extra charge was only 3½ per cent. An additional 1,300 H.P. had been connected in the Treforest area during the year, and the total now connected, including the consumers in the Cwmbran area, was 9,825 H.P. The Treforest Co. were steadily increasing their electrical plant and taking an increasing quantity of current from the company's mains. Arrangements had been made with the Great Western Colliery Co., who were already one of their largest consumers, for the entire supply to the new colliery they were sinking at Llantwit Vardre. A considerably increased output was expected from this source, and from the fact that the Lewis Merthyr Colliery Co., the Albion Colliery Co., and Messrs. Lockett's Merthyr Colliery Co. were making considerable additions to their electrical installations. An agreement had been entered into with the Caerphilly District Council for the acquisition of their electric lighting provisional order, and a supply was being given in such parts of their area as could be reached by a small capital outlay from the company's existing mains. Negotiations were proceeding with other prospective consumers, and it was a very good indication of the general improvement of the position of the company that the Treforest Co., after two years and a-half experience, were considering the question of providing further capital for extending the generating plant, &c., to meet the increasing demand and extend the business of the company. The great thing required to give the company a real measure of success was to secure a substantially increased consumption of current, and the prospects of obtaining this was never so favourable as at the present time.

Mr. W. Forster Brown seconded, and the report and accounts were adopted.

Mr. W. Forster Brown and Mr. John Andrews were re-elected directors, and Mr. J. W. Hutchinson, one of the retiring directors, exchanged seats with Sir Wm. Thomas Lewis, who was a director of the Treforest Co. Consequently, Mr. Hutchinson did not seek re-election, but had been elected a director of the Treforest Co. to fill the vacancy caused by the retirement of Sir Wm. Thos. Lewis. Mr. G. R. Fraser was re-elected auditor.

Colombo Electric Tramways and Lighting Co., Ltd

—The directors have declared a dividend of 6 per cent. for 1909.

London United Tramways Co., Ltd.

On Friday of last week, Mr. C. J. Cater Scott presided over the eighth ordinary general meeting of the above company, held at Winchester House, Old Broad Street, E.C.

The Chairman, in moving the adoption of the report (see Electrical Review, page 660), said he thought that any shareholder who looked at the accounts for the past three or four years would come to the conclusion that the position of the company was unsatisfactory, and in many respects left much to be desired. He said that, although he found that up to the year 1906 there was a reasonable expansion of the receipts. But since that year the reasonable expansion had diminished until last year they were face to face with a very serious falling-off in the revenue. In 1906 they had 45 route-miles open, and the traffic receipts were £325,000; in 1907 the number of miles open had increased to 52½, with traffic receipts £342,000; coming to 1908, when they possessed 55¼ miles, their receipts were £346,000; whilst in 1909, when they had the same number of miles, their receipts dropped to £317,000. There were two chief reasons, he thought, which were peculiarly responsible for this state of affairs. The first was the weather. As they were doubtless aware, 1907 and 1908 were both unfavourable in that respect, whilst 1909 was really disastrous. The pleasure traffic which they looked to, in those three years showed a considerable diminution, and their ordinary traffic fell away. There was no reason, however, why, given better weather, a reasonable expansion of the company's business might not come about. In fact, the present year so far had shown better results. Another thing they had to face was competition, which was by far the most serious cause they had to deal with. The London passenger traffic was carried on to-day under absolutely different conditions to what it was a few years ago, and these new conditions would remain. There might be some slight modifications, but the new conditions were certain to remain. The question, therefore, was, how best to meet the altered circumstances? He did not think he was exaggerating when he said that during the last few years there had been a revolution in the conditions under which London passenger traffic was carried. During that period the District Railway had been electrified, and also the Metropolitan Railway. Then they had the Piccadilly, Hampstead and Bakerloo Tubes—not that he said they all competed with their company. He simply mentioned them as showing the change which had come over London carrying facilities. Another factor was the motor-omnibus. He was reading the other day that there were no less than 1,700 on the London streets. In the case of a 'bus, that was not anchored to one particular route like a tramcar; if it did not pay at one place, it could be used at another. Then on Sunday it could be used for pleasure traffic, and so, in a sense, compete with the London United Co. It was most unfortunate that when they should begin to look forward to seeing an expansion in their receipts, there should be a falling-off. He wanted to be perfectly frank with the shareholders, and to tell them that the increase in their maintenance expenses was not a temporary one, and that, for some time to come, they must certainly look forward to a very considerable charge on that account against their revenue. The reason was that many of their lines had carried a heavy traffic for many years past and naturally showed signs of wear and tear. The shareholders might say that the board should have made provision for it, but that was a difficult question. Had they allocated any surplus for that purpose there would immediately have been an outcry for it to be used for the payment of dividends. Then there was another side to the question. In the ordinary course there was ample justification for believing that the receipts would go on expanding, and thus in course of time would be sufficient for placing to reserve for depreciation. Unfortunately that expansion had not been realised, and the company were face to face with the necessity of taking all the surplus they could get for the purpose of providing for the maintenance of the lines. Turning to the accounts, it would be seen that their gross receipts were down £30,164. The number of passengers carried was 55,750,807 against 59,255,919, a decrease of just on 3½ millions. The legal expenses were rather high, which was accounted for by the fact that they had paid some rather heavy claims. When he mentioned the repairs and maintenance figures they were a serious part in their accounts, so far as the future was concerned. Every item under that heading showed an increase. As he had mentioned before, unfortunately it was not a temporary increase, and it was likely to show an increase for some time to come. The result of that was that they had an increase of £6,334 in their expenses, and a diminution in the traffic receipts, so that altogether they were £37,499 worse off than they were a year ago. He admitted that was a most unsatisfactory state of things. He did not want to be sanguine, in fact, he doubted if anybody could be under the circumstances, but everybody concerned in the management of the company was doing his best to remedy the state of affairs. The balance-sheet showed that they had issued a small amount of debentures, and they had had to realise the investments which appeared in the previous year's accounts. They had had to do that in order to meet capital demands, and even then they had not quite met them. The board had had to carry over a loan of £80,000 from the bankers, and also to draw on the revenue fund, so that to-day capital was indebted to revenue. Dealing with matters of general interest, as they were aware, the company's Bill to extend the period of selling the Hammersmith portions of the company's system to the L.C.C. did not receive the approval of Parliament last year. The London County Council consequently under the powers they possessed had given the company notice of purchase. That notice had been served with the approval of the Board of Trade, despite the fact that the company had appealed to that body to hold an inquiry under the special circumstances of the case. They, however, refused. He asked the shareholders not to put questions on that matter, but to accept what he admitted was the bold statement he had made on the subject. It was a most delicate and complicated matter, and could not be usefully discussed in public. Another matter of importance was the retirement of Sir Clifton Robinson, and on that matter he could speak with perfect frankness. As the shareholders were aware, Sir Clifton had been associated with the company for many years, and his connection with tramways in one part of the world or another had this year extended over a period of 50 years. He thought they would agree that he was certainly entitled to a little rest, and he hoped it would be a good one to Sir Clifton Robinson. Although that reason was absolutely true, there was also another one. The shareholders were aware that for some time the company had been in close association with the Underground Electric Railways, but it had been thought that there should be something more than that. It was thought that if the London United Tramways could be brought under the same general management as those other companies were, it might be of great benefit to the London United Co. This was most clearly put to Sir Clifton Robinson, and he realised the position. In fact, he did more than that. He helped them to carry it out, so that his retirement was an absolutely friendly act, and Sir Clifton Robinson left the board on the very best terms with everybody. He (the chairman) could only thank Sir Clifton for having acted as he had, for had that gentleman chosen he could have made difficulties which would have been very unpleasant and not to the interests of the company. In his place Mr. A. H. Stanley, the manager to the Underground Co., had been elected, and he was quite sure the shareholders would join him (the chairman) in wishing him success in the very arduous work he had undertaken on behalf of the London United Co., which was not of his own choice, but at the solicitation of the London United. Another member of the board, Mr. Chapman, had retired. That gentleman had gone abroad.

Mr. Sydney Holland seconded the motion.

Mr. W. J. Cooke asked whether the Hammersmith system would be acquired as a going concern or at scrap-iron prices.

The Chairman said he really must refuse to be drawn. He was sure the shareholder, considering the interests of the company, would not press his question.

Mr. Cooke said that having regard to the chairman's observation he would withdraw the question. As to the accounts, he agreed that the directors had no control over the weather, but that remark did not apply to the question of the maintenance and renewals of the lines. He thought that in years past the board might have made some provision. He did not wish to make any remarks which would depreciate the pecuniary value of the company's concern, and in view of the chairman's statement that it would be imprudent to answer the question relative to the Hammersmith negotiations, he could only assume that his refusal was in the interests of the company.

The Chairman: Undoubtedly.

The report was adopted.

Subsequently to the general meeting an extraordinary meeting was held, at which a resolution was passed confirming the promotion of the Bill which has been presented to Parliament.

Deutsch-Atlantische Telegrafen Gesellschaft.

The report for 1909 of the German Atlantic Telegraph Co. states that, after the American crisis had been overcome by the end of 1908, the Atlantic telegraph traffic exhibited a rising tendency during the whole of the following year, with the result that the maximum traffic figures, which were attained in 1907, were even surpassed. An increase as compared with the preceding year was also shown in the traffic on the Vigo cable. Some interruptions of the cables again occurred during the year, but they were of short duration, and were chiefly caused by trawlers' nets; nevertheless, it was possible to transmit the traffic without delay by means of the cables which remained undamaged. The Norddeutsche Seekabelwerke, of Nordenham, in which the company continued to hold a financial interest of £150,000, had been engaged on the manufacture of the first section of the cable to South America, and would presumably be constantly in full work during 1910. The amount of that company's dividend of 10 per cent for 1909, devolving upon the Telegraph Co., would only be brought into the latter's accounts for 1910. The accounts contain the following figures for 1909, and those for the previous year are given for the purpose of comparison:—

	1909.	1908.
Share capital	£1,200,000	£1,200,000
Bond capital	948,000	955,800
Gross receipts	239,311	228,669
Cable repairs	6,711	19 858
Cable redemption fund ..	29,797	29,797
Depreciation provision ..	5,683	5,563
Net surplus	148,805	128,923
Dividend	84,000	84,000
,, per cent.	7	7
Carried forward	23,770	22,270

The directors propose to place £6,300 to the ordinary reserve fund, as compared with £5,380 in 1908; £25,000 to the special reserve and repairs fund, as against £10,000 in the preceding year, and £3,750 to the officials' pension, &c., fund, as compared with £2,500, whilst the directors' fees and bonuses to officials amount to £5,480, as compared with £4,760 in 1908.

Auckland Electric Tramways Co., Ltd.

The directors' report states that for the year ended December 31st, 1909, the total revenue was £182,594. The traffic receipts, which amounted to £180,387 show a satisfactory increase of £16,539 over the previous year. After deducting all expenses chargeable to revenue, including £16,455 for debenture interest, the rental and percentage of profits payable to the Auckland City Council amounting to £3,993 and setting aside £15,000 compared with £12,500 last year, to the depreciation account, there is a surplus of £35,124, making with £3,920 brought forward, a total of £39,044. There is to be placed to reserve account £11,500; the dividend on the preference shares for the year required £3,000; and a dividend on the ordinary shares at the rate of 6 per cent. per annum absorbs £21,000, leaving £3,544. At December, 1909, the share and debenture capital of the company was:—£50,000 in 6 per cent. cumulative preference shares of £1 each, fully-paid; £350,000 in ordinary shares £1 each, fully-paid; £329,002 in 5 per cent. first mortgage debenture stock; during the year £3,383 5 per cent. first mortgage debenture stock was bought and cancelled under the operation of the sinking fund, reducing the amount outstanding at December 31st to £329,002. The stock was purchased at a premium which has been charged direct to the profit and loss account. The capital expenditure during the year amounted to £56,601. The largest portion was in connection with an extension of the power house plant and distributing system, which was initiated during the year. An extension of 0·68 of a mile in the Grey Lynn District, which is now approaching completion was commenced, and five additional cars were purchased. At the request of the Auckland City Council the company have agreed to construct along Upper Queen Street, the main thoroughfare in the city, an extension of half a mile. An extension of 0·775 in the Mount Albert Road district to Morningside Station has also been agreed to. Further suggested extensions of the system have been placed before the board and are receiving careful consideration. In addition to the five cars added to the rolling stock during the year eight further cars have been ordered and are under construction, bringing the total up to 100. It having been found inconvenient to close the accounts on December 31st, it has been decided in future to close the financial year on June 30th; consequently the next published report and accounts will be for the six months ended June 30th, and thereafter the annual accounts presented will be for the year ended June 30th instead of December 31st as at present.

	1908.	1909.
Miles open—Route miles	22·3	22·3
Single line	8·15	8·15
Double line	14·15	14·15
Number of passengers carried	26,144,320	28,736,965
Average receipts per passenger	1·50d.	1·50d.
Average expenditure per passenger	0·92d.	0·93d.
Proportion of expenses to receipts	61 %	62 %
Number of cars working	87	92

Neuhausen Aluminium Industry Co.

The report for 1909 of the Aluminium Industrie Gesellschaft, of Neuhausen, states that the keen competition which started in 1908 lasted throughout 1909, and continual concessions in prices had to be made to obtain orders. Owing to these circumstances, a profitable result was out of the question for the principal branch from the beginning, but the company's works were fully employed during the year. The profits on manufacturing were less than in the preceding year, but the yield from participations in various undertakings was considerably greater. The accounts show the following figures, which are compared with those for 1908:—

	1909.	1908.
Share capital paid	£520,000	£520,000
Bond capital	213,000	220,000
Brought forward	42,000	54,000
Working profits	125,000	132,000
Investment yield	33,000	22,100
Working expenses, &c.	39,000	37,800
Depreciation provision	87,000	17,600
Net profits and balance forward	124,000	166,000
Dividend	62,000	93,600
Dividend per cent.	12	18
Carried forward	38,000	42,000

It will be seen that the amount appropriated for depreciation is greater than in 1908, but it is less than half of that allocated to the same purpose either in 1907 or 1906, when dividends of 20 and 22 per cent. were respectively paid. The directors' fees or share in the profits are likewise less than in the more favourable years, as also are the amounts provided for pension and benevolent funds.

The report, in referring to the subsidiary undertakings, states that the extension of the Rhone works in the Valais is approaching completion. One part of the works will be brought into operation in the current year, and will take up the manufacture of nitric acid and nitrogen derivatives on the arrival of high-water conditions. Among the Valais concessions acquired at one time was the water-power of the Borgne, a tributary of the Rhone, and this is to be taken in hand slowly. The works at Marseilles, which is included among the auxiliary companies, has been at work for some time past, and supplies raw material to the aluminium works in the Valais. It is added that as the use of aluminium has been extended to new branches and the consumption has largely increased, the orders on hand are regarded as favourable, whilst prices have improved as compared with last year.

Eastern Telegraph Co., Ltd.—A final dividend of 25s. per cent. and a bonus of £2 per cent. are announced, making 7 per cent. for the year 1909.

Urban Electric Supply Co., Ltd.

The directors' report for the year ended December, 1909, states that the gross profits amount to £44,872, and, after deducting the London expenses, there is a balance of £42,733, which has been carried down to net profit and loss account. After adding in the last-mentioned account £379, interest received on deposit, making a total of £43,113, and after deducting items appearing on the other side of this account, amounting together to £14,235, there remains a profit balance of £28,878, which falls short by £3,622 of the amount of £32,500, also appearing, required to meet the 5 per cent. guaranteed dividends on the capital of the company. This deficit, being the debit balance as shown in the accounts, has been duly provided by Edmundsons' Electricity Corporation, Ltd., under their contract. Provision has been made of £1,971 for depreciation of plant and machinery under the terms of the agreement with the contractors. The comparative statement is appended:—

	35-watt lamps connected at Dec.		Average capital,	Profits.		
	1908.	1909.	1909.	1907.	1908.	1909.
Hawick	38,736	44,725	£66,390	£3,558	£2,949	£3,976
Stamford	30,555	32,573	50,882	1,524	1,836	1,532
Weybridge and Walton	51,322	56,423	122,653	4,830	5,227	6,056
Godalming	26,590	27,549	56,874	2,281	2,976	3,406
Twickenham Co.	84,413	92,954	228,132	8,125	7,269	8,339
Dartmouth	22,994	23,478	54,869	1,546	2,163	2,586
Camborne and Redruth	60,997	69,698	169,663	5,795	6,631	7,920
Newton Abbot	14,948	16,509	43,226	178	1,060	1,452
Grantham	34,677	36,032	66,128	2,344	2,234	2,526
Glossop	25,693	26,141	106,406	3,373	2,908	2,999
Berwick	17,283	18,463	30,364	1,252	1,130	1,297
Caterham	12,208	12,665	34,273	347	797	950
Newbury	17,087	19,386	52,220	1,256	1,610	1,811
	437,503	476,596		£36,409	£38,791	£44,850

Babcock & Wilcox, Ltd.—The annual meeting was held on April 22nd, when the report printed in our issue of April 22nd was adopted. Mr. John Dewrance, who presided, said that they had earned a record profit. In reply to a question regarding the pension fund, he said it was intended to limit its benefits to the heads of departments and the staff. The question of providing for the workmen must be left to the Government. It was not easy to make any provision for workmen, because they changed their employment so frequently, and their trade unions and other arrangements interposed a great number of difficulties.

German Babcock & Wilcox Co.—According to a Berlin dispatch to the *Financial News*, these steam boiler works at Oberhausen have obtained very satisfactory results for the last six months. The value of orders to hand exceeds that for the corresponding period of last year by about M. 2,000,000. The invoice value of the past business year amounted to M. 4,500,000.

Arbroath Electric Light and Power Co., Ltd.—The second annual general meeting was recently held at the office in Arbroath, Mr. George Balfour presiding. The chairman, in moving the adoption of the accounts, referred to the large increase in the number of consumers and to the excellent prospects of the company. He also stated that the directors were considering the advisability of increasing the plant at the power station. The accounts showed a net profit for the year of £427, which, together with £77 brought forward, made a total of £503, and it was agreed to carry this sum forward.

Continental.—France.—The balance-sheet of La Compagnie Francaise pour l'Exploitation des Procédés Thomson-Houston, of Paris, for the last financial year shows a profit of £153,368, as contrasted with £105,859 in the preceding 12 months.

Spain.—La Compagnie des Cables Electriques, of Barcelona, is declaring a dividend at the rate of 5 per cent. for the last financial year.

Germany.—The balance-sheet of the Bergmann Electricitätswerke Gesellschaft, of Berlin, for the last financial year shows a gross profit of £261,424, as compared with only £224,199 in the preceding 12 months. A dividend at the rate of 18 per cent. is being maintained.

Russia.—La Société Siemens et Halske, of St. Petersburg, is declaring a dividend of 5 per cent. for the last financial year.

Calcutta Electric Supply Co., Ltd.—The directors have declared a dividend at the rate of 9½ per cent. per annum on the ordinary shares for the half-year, making 8 per cent. for the year, placing £17,000 to depreciation and renewals account.

Belgium.—The balance-sheet of the Société de l'Electricité du Pays de Liége, of Liége, for the last financial year shows a net profit of £5,430, out of which a dividend of 5 per cent. is being paid on the preference shares.

Prospectus.—*India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.*—In virtue of powers given at meetings held in June and July, 1908, the directors are now increasing the paid-up capital by the issue of 12,500 £5 per cent. cumulative preference shares of £10 each, at £10 2s. 6d. per share.

West India and Panama Telegraph Co., Ltd.—A dividend of 6s. per share on the first preference shares for the half-year ended December, 1909, has been announced, and one of 9s. per share on the second preference on account of dividends accrued to December, 1909.

Held Over.—Pressure upon our space compels us to hold over, until next week, reports of several company meetings.

MARKET QUOTATIONS.

Wednesday, April 27th.

CHEMICALS, &c.		Latest Price.	Fortnight's Inc. or Dec.
a Acid, Hydrochloric	per cwt.	5/-	..
a „ Nitric	„	22/-	..
a „ Oxalic	„	28/-	..
a „ Sulphuric	„	5/6	..
a Ammoniac, Sal	„	42/-	..
a Ammonia, Muriate (crystal) ..	per ton	£29	..
a „ „	„	£30	..
a Bleaching powder	„	£5 10	..
a Bisulphide of Carbon	„	£18	..
a Borax	„	£16	..
a Ferro-Silicon (50 %)	„	£10	..
a Copper Sulphate	„	£18	£1 dec.
a Lead, Nitrate	„	£26	..
a „ White Sugar	„	£23 10	..
a „ Peroxide	„	£32	..
a Methylated Spirit	per gal.	2/6	..
a Potassium, Bichromate, in casks	per lb.	8½d.	..
a Potash, Caustic (75/80 %) ..	per ton	£20	..
a „ Chlorate	per lb.	8½d.	..
a „ Perchlorate	„	4½d.	..
a Potassium, Cyanide	„	7d.	..
a Shellac	per cwt.	70/-	5/- dec.
a Sulphate of Magnesia	per ton	£4 10	..
a Sulphur, Sublimed Flowers ..	„	£6 10	..
a „ Recovered	„	£5 10	..
a „ Lump	„	£5	..
a Soda, Caustic (white 70 %) ..	„	£11	..
a „ Chlorate	per lb.	3½d.	..
a „ Crystals	per ton	£3 5	..
a Sodium Bichromate, casks ..	per lb.	3d.	..
a „ Cyanide (basis 100 %) ..	„	7d.	..
METALS, &c.			
b Aluminium Ingots, in ton lots ..	per ton	£80	..
b „ Wire, in ton lots ..	„	£112	..
b „ Sheet, in ton lots ..	„	£120	..
p Babbitt's metal ingots ..	„	£38 to £145	..
c Brass (rolled metal 2" to 12" basis)	per lb.	7⅝d.	..
c „ Tube (brazed)	„	9¼d.	¼d. inc.
c „ „ (solid drawn) ..	„	7¼d.	¼d. inc.
c „ Wire, basis	„	6⅝d.	..
c Copper Tubes (brazed)	„	9d.	..
c „ „ (solid drawn ..	„	8¼d.	..
g „ Bars (best selected) ..	per ton	£70	£1 dec.
g „ Sheet	„	£70	£1 dec.
g „ Rod	„	£70	£1 dec.
e „ (Electrolytic) Bars ..	„	£60	£1 dec.
e „ „ Sheets ..	„	£76 5	£1 dec.
e „ „ Rod ..	„	£64 15	£1 dec.
e „ „ H.C. Wire	per lb.	7¾d.	¼d. dec.
f Ebonite Rod	„	6/-	..
f „ Sheet	„	5/6	..
n German Silver Wire	„	1/6	..
h Gutta-percha, fine	„	6/6 to 11/-	..
h India-rubber, Para fine	„	11/10	5d. dec.
i Iron Pig (Cleveland warrants) ..	per ton	50/2	1/8½ dec.
i „ Wire, galv. No. 8, P.C. qual.	„	£14	..
g Lead, English Ingot	„	£12 17 6	2/6 dec.
m Manganin Wire No. 28	per lb.	6/6	..
g Mercury	per bot.	£9 5	..
d Mica (in original cases) small ..	per lb.	6d. to 1s.	..
d „ „ „ medium	„	2/6 to 4/-	..
d „ „ „ large ..	„	4/6 to 8/6	..
p Phosphor Bronze, plain castings	„	11d.	..
p „ „ rolled bars & rods	„	1/3	..
p „ „ rolled strip & sheet	„	1/3	..
o Platinum	per oz.	120/-	variable.
e Silicium Bronze Wire	per lb.	8½d.	¼d. dec.
r Steel Magnet, in bars	per ton	£55	..
g Tin, Block (English)	„	£149 to £150	£2 inc.
n „ Wire, Nos. 1 to 16	per lb.	1/10	..
p White Anti-friction Metals:—			
"Ibis" brand	per ton	£45 to £150	..
k Zinc, Sh't (Vieille Montagne bnd.)	„	£26 15	..

Quotations supplied by—

a G. Boor & Co.
b The British Aluminium Co., Ltd.
c Thos. Bolton & Sons, Ltd.
d F. Wiggins & Sons.
e Frederick Smith & Co.
f India-Rubber, Gutta-Percha and Telegraph Works Co., Ltd.
g James & Shakspeare.
h Edward Till & Co.
i Bolling & Lowe.
k Morris Ashby, Ltd.
l Richard Johnson & Nephew, Ltd.
m W. T. Glover & Co., Ltd.
n P. Ormiston & Sons.
o Johnson, Matthey & Co., Ltd
p London Phosphor Copper & Bronze Co., Ltd.
r W. F. Dennis & Co.

Stock Exchange Notices.—The Committee have ordered the undermentioned securities to be quoted in the Official List:—

British Columbia Electric Railway Co.—Further issue of £200,000 5 per cent. cumulative perpetual preference stock; £200,000 preferred ordinary stock; and £100,000 deferred ordinary stock.

La Plata Electric Tramways Co.—170,000 6 per cent. cummulative preference shares of £1 each, 7s. 6d. paid, Nos. 1 to 170,000.

Coventry Electric Tramways Co., Ltd. — The directors report that the gross earnings for the year to December 31st were £28,350, the cost of operation £18,729, and the net earnings £9,621. The net profit for the year, after taking into account £1,530 paid for interest on mortgage bonds, and £1,152 for interest on the amount owing to New General Traction Co., Ltd., was £6,939, plus £57 brought forward, making together £6,996. The directors recommend that £2,000 be placed to reserve for depreciation, £4,550 to the payment of 3½ per cent. dividend on the share capital, £446 being carried forward.

STOCKS AND SHARES.

Tuesday Evening.

The rubber boom has been rent, and the oil boom has received a decided check. While the prices of rubber shares are maintained at comparatively high levels, the enthusiasm for the craze is evaporating, and although there are plenty of prophets who look for its triumphant ascent before long, the wildness of the gamble has passed away for the time being.

On the other hand, there is not much reaction in the price of the raw material. From all quarters come complaints of the increasing cost of rubber, and it will be a remarkable thing if the next batches of reports from electrical and telegraph companies do not contain harrowing accounts of the extra expenditure involved by the boom in rubber.

The relapse in Home Railway stocks has made further downward progress. Complete lack of public interest appears to be the real reason for the gradual sagging away. City and South London Ordinary lost a point of its recent rise. Central Londons are steady, but Metropolitan Consolidated went back, and so did Districts.

Now that the Anglo-Japanese Exhibition is close to its opening, the Railway market takes no notice whatever of this prospective event, whereas, some six months ago, all kinds of bullish anticipations were being indulged as to its probable effect upon traffics.

London United Tramways Preference rose 5s. last week, but this week they have fallen 10s., and the Debenture stock is 2 points lower. Careful consideration of the report printed here last Friday could lead only to the conclusion that it is, as we then said, exceedingly bad. Where, or from what direction, better luck may be expected, it is difficult to see, but the change in management may tend to help matters. The strictures passed upon the London United Tramways' methods which it was necessary to reiterate here time after time, have been, most unhappily, verified up to the hilt; but it is not to be supposed that there will be many other companies profiting by this glaring illustration of the disasters which wait upon the policy of paying dividends to the neglect of building up reserves.

Electricity Supply stocks and shares are quite as wildly active as usual. City of London 4½ per cent. Second Debenture stock is a point higher, investment attention recognising the cheapness of the security. County Ordinary fell 5s. No other movements have occurred amongst the London issues, and the provincial descriptions are equally quiet. Mexican Light and Power Preferred receded ½.

Mexico Tramways shares, and the bonds, are ½ lower. Rio Trams at 96¼ show a fall of ¾, and the Bonds are equally weaker Sao Paulos are 150. British Electric Tractions Preference shed ⅛ of their previous sharp rise.

As a matter of merely domestic interest, it may be mentioned that proposals are afoot to carve out a new market in the Stock Exchange for the Mexican-Canadian varieties. At present, they are dealt in conglomerated with rubber, oil and home industrial shares. It is thought by some of the leading firms of dealers that the time has come when a separate department might be given up to the above-named group, which will therefore in all probability start a new lease of existence in a market all its own, in the Stock Exchange, of course, before very long.

What few movements there are in the Telegraph department do not favour holders, except as regards Eastern Extension shares, which show a small advance. Westerns are easier; so are West India and Panama, and Commercial Cable Debentures. Anglo-American Telegraph Deferred suffered in sympathy with a sharp drop in the American Railroad market, but Mackay Companies' common shares are a point to the good.

National Telephone Third Preference fell $\frac{3}{16}$ on a very slight attempt on somebody's part to sell. Orientals are $\frac{3}{32}$ higher. American Telephone and Telegraph stock fell 1. Marconi's did not respond in any way to the opening of the company's wireless service to Canada.

Of the manufacturing shares, Babcock & Wilcox are the most buoyant, registering 2s. 6d. rise. British Westinghouse Debentures continue to creep up. The official quotation for British Aluminium 5 per cent. mortgage Debenture stock is 75 to 80. Castner-Kellner's are $\frac{1}{16}$ higher at 2$\frac{13}{16}$ middle. The new India-Rubber shares are about 1s. premium.

Eastern Extension, Australasia and China Telegraph Co., Ltd.—The directors have declared a dividend for the quarter ended December 31st last of 2s. 6d. per share, together with a bonus of 4s. per share (or 2 per cent.), making a total distribution of 7 per cent. for the year 1909.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. *	Dividends for the last four years.				Closing Quotations April 19th.	Closing Quotations April 26th.	Business done week ended April 26th, 1910.		Rise + or Fall —	Present Yield per cent.
			1906.	1907.	1908.	1909.			Highest.	Lowest.		£ s. d.
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	Nil	8⅜ — 8⅞	8⅜ — 8⅞	..	..	..	Nil.
116,200	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	5 %	5 %	5 %	5 %	100 —102	100 —102	..	..	..	4 18 0
$255,196,000	American Telephone & Telegraph, Cap. Stock ..	$100	8 %	8 %	8 %	8 %	140 —142	138 —141	139	..	+1½	5 13 6
$58,000,000	Do. Collat. Trust, 4% Bonds, 1 to 28,000 and 53,001 to 78,000	$1000	4 %	4 %	4 %	4 %	93 — 95	93 — 95	..	..	..	4 4 3
558,460	Anglo-American Telegraph	Stock	3½%	3½%	£3 4s.	3⅜%	59 — 61 xd	59 — 61 xd	60½	..	..	5 18 10
3,220,770	Do. do. do. 6 % Pref.	Stock	6 %	6 %	6 %	6 %	101 —103 xd	101 —102 xd	102	101	..	5 17 8
3,220,770	Do. do. do. Deferred	Stock	1¾%	1 %	8/-	25/-	18⅜ — 19½	18 — 18½	18⅝	..	— ⅜	6 15 2
47,725	Anglo-Portuguese Tel., 5 % Mort. Deb. Stock Red.	100	5 %	5 %	5 %	5 %	99½ —101½	99⅜ —101½	101	..	..	4 18 6
44,000	Chili Telephone, Nos. 1 to 44,000	5	8 %	8 %	8 %	..	8 1/16 — 8 3/16	8 1/16 — 8 3/16	..	..	..	4 16 3
2,449,176	Commercial Cable, Sling. 500 year 4% Deb. Sk. Red.	Stock	4 %	4 %	4 %	4 %	87 — 89 xd	86 — 88	88⅜	87½	—1	4 10 11
16,000	Cuba Telegraph	10	6 %	6 %	6 %	6 %	8⅜ — 9⅛	8⅜ — 9⅛	..	..	..	6 6 4
6,000	Do. 10 % Pref.	10	10 %	10 %	10 %	10 %	17½ — 18½	17½ — 18½	..	..	..	5 9 7
12,981	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	..	3¼ — 3⅜	3¼ — 3⅜ xd	..	..	..	5 3 3
6,000	Do. do. 10 % Cum. Pref. ..	5	10 %	10 %	10 %	10 %	7⅞ — 8⅛ xd	7⅞ — 8⅛ xd	..	..	..	6 1 3
80,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
60,710	Direct United States Cable	20	4½%	4½%	4½%	4 %	13¼ — 14 xd	13¼ — 14	13½	..	..	6 1 5
39,500	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200, R.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
4,000,000	Eastern Telegraph, Ord. Stock..	Stock	7 %	7 %	7 %	..	136 —139	135½ —138½	138	136	—1½	5 1 1
2,000,000	Do. 3½ % Pref. Stock..	100	3½%	3½%	3½%	3½%	86 — 88	86 — 88	87½	86½	..	4 1 5
1,896,706	Do. 4 % Mort. Deb. Stock. Red. ..	Stock	4 %	4 %	4 %	4 %	103 — 105	103 —105	103½	..	..	3 16 2
800,000	Eastern Extension, Australasia, and China Tele	10	7 %	7 %	7 %	7 %	12⅜ — 13¼	12⅜ — 13¼	13 1/16	12⅞	+ ⅛	5 5 8
752,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %	101 —103	101 —103	..	..	..	3 17 8
200,000	East. & S. Afric. Tel., 4 % Mt Db. Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	4 %	100 —103	101 —103	..	..	..	3 17 8
181,127	Globe Telegraph and Trust	10	5½%	5½%	5½%	..	10¾ — 11	10¾ — 11	10⅞	..	..	5 4 7
181,127	Do. do. 6 % Pref...	10	6 %	6 %	6 %	6 %	13⅜ — 13⅝	13⅛ — 13⅜	13½	13 7/32	..	4 8 1
150,000	Great Northern Telegraph, of Copenhagen.. ..	10	20 %	20 %	18 %	..	21½ — 22½	31½ — 32½	32⅜	..	..	5 11 8
5,000	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	..	..	..	4 8 3
17,000	Indo-European Telegraph	25	18 %	18 %	18 %	18 %	54½ — 56½	54½ — 56½	54½	..	..	5 14 0
$41,980,400	Mackay Companies Common	$100	3½%	4 %	4 %	4½%	91 — 93	92 — 94	..	..	+1	4 10 5
$50,000,000	Do. do. 4% Cum. Pref.	$100	4 %	4 %	4 %	4 %	78 — 80	78 — 82	..	..	+1	4 17 7
894,190	Marconi's Wireless Telegraph	1	Nil	Nil	Nil	..	3/16 — 7/16	3/16 — 7/16	17/-	15/9	..	Nil
72,680	Monte Video Telephone Co., Ltd. Ord.	1	6 %	6 %	6 %	6 %	¾ — 1	¾ — 1	..	..	..	6 0 0
86,492	Do. do. do. 5 % Pref.	1	5 %	5 %	5 %	5 %	3/16 — 7/16	3/16 — 7/16	..	..	..	5 6 8
2,225,000	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %	104 —105½	104 —105½	105	104	..	5 13 9
3,725,000	Do. do. Def. Stock	100	5 %	6 %	6 %	6 %	124 —126	124 —126	125½	124	..	4 15 3
15,000	Do. do. 6 % Cum. 1st. Pref.	10	6 %	6 %	6 %	6 %	10⅜ — 10⅞	10⅜ — 10⅞	..	..	..	5 10 4
15,000	Do. do. 6 % Cum. 2nd Pref.	10	5 %	6 %	6 %	6 %	10 — 10⅜	10 — 10⅜	..	..	..	5 11 8
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %	5⅜ — 5⅝	5 1/16 — 5 1/16	..	..	— 1/16	4 11 11
2,000,000	Do. do. 3½ % Deb. Stock Red. ..	Stock	3½%	3½%	3½%	3½%	97½ — 99½	97½ — 99¼	99	..	..	3 12 2
1,988,593	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	99 —101	98 —100	..	..	— 1	4 0 0
179,313	Oriental Telep. and Elec. 1 to 171,504, fully paid ..	1	7 %	8 %	8 %	8 %	1 11/16 — 1 13/16	1⅝ — 1¾	29/4½	..	+ 3/32	5 6 8
50,000	Do. do. do. 6 % Cum. Pref... ..	1	6 %	6 %	6 %	6 %	1 3/16 — 1 5/16	1 1/16 — 1 1/16	..	..	..	4 14 9
195,955	Do. do. do. 4 % Red. Deb. Stock ..	100	4 %	4 %	4 %	4 %	86 — 88	86 — 88	..	..	..	4 10 11
99,400	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	10	4 %	4 %	4 %	4 %	98 —100	98 —100	..	..	..	4 0 0
11,889	Reuter's	8	5 %	5 %	5 %	..	7⅞ — 8⅛	7⅞ — 8⅛	..	..	..	4 18 9
145,955	Telephone Co. of Egypt, 4½ % Deb. Red.	100	4½%	4½%	4½%	4½%	100 —102	100 —102	100	..	..	4 8 3
9,042	Submarine Cables Trust	Certs.	6 %	6 %	6 %	..	128 —131 xd	128 —131 xd	..	..	..	4 11 7
120,000	United River Plate Telephone	5	8 %	8 %	8 %	..	7⅛ — 7⅜	7⅛ — 7⅜	7⅛	..	..	5 8 6
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	5 %	5⅜ — 5⅝	5⅜ — 5⅝	..	..	..	4 8 11
80,008	W. Coast of America, 1 to 80,000 & 53,001 to 58,008	2½	2½%	2½%	2½%	..	1⅜ — 1⅝	1⅜ — 1⅝	..	..	..	3 16 4
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Brss. Sub. Tel.	100	4 %	4 %	4 %	4 %	98 —100	98 —100	..	..	..	4 0 0
207,980	Western Telegraph, Ltd., Nos. 1 to 207,980.. ..	10	7 %	7 %	7 %	..	13⅜ — 14½	13⅜ — 14	13 3/8	13½	— ⅛	5 0 0
800,000	Do. do. 4 % Deb. Stock Red. ..	100	4 %	4 %	4 %	4 %	101 —103	101 —103	..	..	..	3 17 8
88,231	West India and Panama Telegraph	10	Nil	Nil	Nil	..	3/16 — 5/16	3/16 — 7/16	15/6	..	—1/16	Nil
84,558	Do. do. 6 % Cum. 1st Pref.	10	8 %	6 %	6 %	..	8⅜ — 9½	8⅜ — 9½	..	..	..	6 9 9
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	£2 6	15 %	..	8¼ — 9¼	8¼ — 9¼	..	..	..	6 9 9
80,000	Do. do. 5 % Debs., Nos. 1 to 1,800 ..	100	5 %	5 %	5 %	5 %	100½ —102½	100½ —102½	..	..	..	4 17 1

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

640,000	Anglo-Argentine Trams, 5 % Cum. 1s Pref., 1 to 640,000	5	..	..	..	5 %	4 1/16 — 4 3/16	4 1/16 — 4 3/16	96/3	91/3	..	5 1 3
500,000	Do. 5 % 2nd Pref., 800, to 1,300,000	5	..	..	..	5 %	4 1/16 — 4 3/16	4 1/16 — 4 3/16	..	..	..	5 6 8
4,465,674	Do. 4 % Deb. Stock	Stock	..	..	4 %	4 %	90½ — 92	92½ — 92	91½	90½	..	4 7 0
882,387	Auckland E. Trams, 5 % 1st Mort. Deb. Stock ..	100	5 %	5 %	5 %	5 %	105 —107	105 —107	..	..	..	4 13 6
880,000	Babcock & Wilcox, 1 to 580,000	1	20 %	20 %	20 %	24 %	5½ — 5⅝	5½ — 5½	5 1/16	5⅛	..	4 9 5
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000 ..	1	6 %	6 %	6 %	6 %	1 1/16 — 1 1/8	1 1/16 — 1 1/8	..	..	..	3 19 2
60,000	British Aluminium, Ord., 1 to 40,000	5	7 %	7 %	Nil	..	..	..	..	..	..	Nil
60,000	Do. do. 7 % Cum. Pref.	5	7 %	7 %	3½%	..	..	..	..	..	..	..
40,100	Do. do. "A" 6 % Cum. Pref.	5	6 %	6 %	6 %	..	..	..	..	..	..	..
12,897	Do. do. 4 % Funding Certs.	5	4 %	4 %	2 %	..	..	..	..	..	..	..
124,400	Do. do. 5½ % Loch Leven Debs. ..	100	5½%	5½%	5½%	5½%	97 —100	97 —100	..	..	..	5 10 0
500,000	British Columbia E. Rail Def. Ord. Stock	100	6 %	8 %	8 %	8 %	145 —150	145 —150	146½	146	..	5 6 8
400,000	Do. Pref. Ord. Stock	100	5 %	5 %	6 %	6 %	121 —125	121 —125	122½	121	..	4 16 0
400,000	Do. 5 % Cum. Perp. Pref. Stock	100	5 %	5 %	5 %	5 %	110 —112	108 —110	109½	108½	—2	4 10 11
238,000	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	4½%	4½%	4½%	4½%	101 —103	101 —103 xd	..	..	..	4 7 5
212,600	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	4½%	4½%	4½%	4½%	102 —105	102 —105	..	..	..	4 5 9
188,301	British Electric Traction	10	Nil	Nil	Nil	..	1 — 1⅛	1 — 1⅛	23/9	..	..	Nil
161,437	Do. do. 6 % Cum. Pref.	10	6 %	3 %	1¾%	..	3⅞ — 4⅛	3½ — 3⅞	80/-	78/1½	— ⅝	4 0 0
1,473,658	Do. do. 5 % Perp. Deb. Stock ..	Stock	5 %	5 %	5 %	..	90 — 93	90 — 93 xd	92½	91	..	5 7 6
598,986	Do. do. 4½ % 2nd Perp. Stock Red.	100	4½%	4½%	4½%	..	68 — 73	68 — 72	..	..	..	6 5 0
100,000	British Insulated and Helsby Cables	10	10 %	10 %	10 %	10 %	6½ — 7⅛	6½ — 7⅛	7⅛	..	..	6 17 11
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %	6 — 6½	6 — 6½	..	..	..	4 12 4
500,000	Do. do. 4½ % 1st Mort. Deb. Red. ..	100	4½%	4½%	4½%	4½%	103 —106	103 —106	..	..	..	4 4 11
204,940	British Thomson-Houston 4½ % 1st Mort. Debs.	100	4½%	4½%	4½%	4½%	91 — 95	93 — 96	..	..	+1½	4 13 9
400,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 75,000	5	Nil	Nil	Nil	..	3/8 — 5/16	3/8 — 5/16	7/6	..	..	Nil
1,916,268	Do. do. 4 % Mort. Deb. Stock ..	100	4 %	4 %	4 %	..	47 — 51	47 — 51	48½	..	..	7 16 10
50,000	‡Browett, Lindley & Co., Ord.	1	Nil	Nil	Nil	..	3/16 — 7/16	3/16 — 7/16	..	..	..	Nil
50,000	‡ Do. do. 6 % Cum. Pref.	1	Nil	Nil	Nil	..	14/6 to 15/6	14/6 to 15/6	..	..	..	Nil
140,976	Brush Electrical Engineering, Ord., 1 to 105,731 ..	2	Nil	Nil	Nil	..	0 — ⅛	0 — ⅛	..	..	..	Nil
200,000	Do. do. Non-cum. 6 % Pref.	2	Nil	Nil	Nil	..	0 — ⅛	0 — ⅛	..	..	..	Nil
135,000	Do. do. 4½ % Perp. Deb. Stock ..	Stock	4½%	4½%	4½%	4½%	39 — 44	39 — 44	..	..	..	10 4 6
135,000	Do. do. 4½ % Perp. 2nd Deb. Stock..	Stock	4½%	4½%	4½%	4½%	25 — 29	25 — 29	..	..	..	15 3 0
137,610	Calcutta Trams, 1 to 137,610	5	8 %	6 %	4½%	4½%	4⅜ — 4⅞	4⅜ — 4⅞	..	..	..	4 12 4
45,804	Do. 5 % Cum. Pref., Nos. 1 to 29,330..	5	5 %	5 %	5 %	5 %	4½ — 5	4½ — 5	..	..	..	5 0 0
950,000	Do. 4½ % 1st Deb. Stock..	100	4½%	4½%	4½%	4½%	99 —102	99 —102	100	..	..	4 8 3
35,000	Callender's Cable Construction shares	5	15 %	15 %	15 %	..	10 — 10¼	10 — 10¼	..	..	..	6 19 6
40,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	5 %	5⅛ — 5⅜	5⅛ — 5⅜	..	..	..	4 10 11
800,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	102½ —104½	102½ —104½	..	..	..	4 6 2
491,222	Cape E. Trams., 1 to 491,222	1	Nil	Nil	Nil	..	1/16 — 3/16	1/16 — 3/16	..	..	..	Nil
450,000	Castner-Kellner Alkali, 1 to 450,000	5	8 %	12 %	12½%	..	2 1/16 — 2 1/8	2⅛ — 2 1/16	55/6	56/-	+ 1/16	4 7 9
710,153	Do. do. 4½ % 1st Mort. Deb. Stock	100	4½%	4½%	4 %	4½%	104 —107	104 —107	..	..	..	4 4 1
1,890 690	Central London Railway, Ord. Stock	Stock	4 %	3 %	3½%	3 %	70 — 72	70 — 72	..	..	..	4 3 4
554,655	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %	86 — 88	86 — 88	87½	..	..	4 10 11
554,655	Do. do. Def. do.	Stock	4 %	2 %	2½%	2 %	53 — 55	53 — 55	53½	..	..	3 12 9
1,180,000	City and South London Railway	Stock	2½%	3½%	1½%	1¾%	36 — 37	35 — 36	36⅜	35	—1	4 17 3
85,000	Crompton & Co., Nos. 1 to 85,000	8	5 %	5 %	Nil	..	3/8 — 7/16	3/8 — 7/16	..	..	..	Nil
100,000	Do. 5 % 1st Mort. Reg. Debs., 1 900 of £100, and 901 11,000 of £50 Red	..	5 %	5 %	5 %	5 %	88 — 91	88 — 91	..	..	..	5 9 11

* Unless otherwise stated, all shares are fully paid. ‡ From Manchester Share List.

Continued on next page.

SHARE LIST OF ELECTRICAL COMPANIES.—(Continued.)

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—(Continued)

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years. 1906.	1907.	1908.	1909	Closing Quotations April 19th.	Closing Quotations April 26th.	Business done week ended April 26th, 1910. Highest	Lowest.	Rise + or Fall —	Present Yield. per cent. £ s. d.
260,000	Dick, Kerr & Co., 1 to 260,000	* 1	10 %	10 %	6 %	..	⅞ — 1	⅞ — 1	..	..	..	6 0 0
305,000	Do. do. 6 % Cum. Pref., 1 to 305,000	1	6 %	6 %	6 %	6 %	1 3/32 — 1 5/32	1 3/32 — 1 5/32	23/1 1/2	..	..	5 4 4
271,080	Do. do. 4½ % Deb. Stock	100	4½ %	4½ %	4½ %	4½ %	99 —102	99 —102	..	..	..	4 8 3
60,000	Dublin United Trams. (1896), 6 % Pref., 1 to 60,000	10	6 %	6 %	6 %	6 %	13 — 14	13 — 14	..	..	..	4 7 8
99,261	Edison & Swan Utd., "A" shs., £8 pd., 1 to 99,261	5	4½ %	2½ %	Nil	..	1/16 — 1/8	1/16 — 3/16	..	..	..	Nil
17,189	Do. "A" shares, 01—017,189	5	4½ %	2½ %	Nil	..	1 — 1½	1 — 1½	..	..	..	Nil
307,895	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	65 — 70	65 — 70	..	..	..	5 14 4
87,720	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	5 %	79 — 82	79 — 82	..	..	..	6 1 11
112,100	Electric Construction, 1 to 112,100	2	Nil	Nil	Nil	..	1/4 — 3/8	1/4 — 3/8	6/3	..	..	Nil
81,890	Do. do. 7 % Cum. Pref., 1 to 81,890	2	7 %	7 %	7 %	7 %	1 5/16 — 1 7/16	1 5/16 — 1 7/16	..	..	..	9 0 8
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	..	7¾ — 8¼	7¾ — 8¼	..	..	..	6 1 8
200,000	Do. do 4 % Mort Deb.	Stock	4 %	4 %	4 %	4 %	82 — 86 xd	82 — 86	..	..	..	4 18 0
78,000	Gt. N. & City Rail. Pref. Ord. "A" 4 %, 1 to 78,000	10	4 %	¼ %	Nil	..	⅜ — ½	⅜ — 1	..	..	+ ⅛	Nil
96,000	Greenwood & Batley, 7 % Cum. Pref.	10	7 %	7 %	..	..	10¼ — 10½	10½ — 10⅝	..	..	..	6 10 8
80,000	Do. do. 5 % Mort. Debs.	100	5 %	5 %	5 %	..	102 —103½	102 — 103½	..	..	..	4 16 10
40,000	Henley's (W. T.), Telegraph Works, Ord.	5	15 %	15 %	15 %	15 %	12⅜ — 13⅛	12⅜ — 13¼	12⅜	12⅜	..	5 14 3
40,000	Do. do. 4½ % Pref.	5	4½ %	4½ %	4½ %	4½ %	5 — 5⅛	5 — 5⅛	..	..	..	4 3 9
150,000	Do. do. 4½ % Mort. Deb. Stock	Stock	4½ %	4½ %	4½ %	4½ %	105½—107½	105½—107½	..	..	..	4 3 9
50,000	India-Rubber, Gutta-percha & Telegraph Works.	10	10 %	10 %	10 %	10 %	15½ — 16	15½ — 16	15½	..	..	6 5 0
97,500	†Liverpool Overhead Railway, Ord.	10	Nil	½ %	Nil	Nil	3/32 — 7/32	3/32 — 7/32	..	..	..	Nil
10,000	† Do. do. Pref., fully paid	10	5 %	5 %	5 %	5 %	5⅛ — 5⅜	5⅛ — 5⅜	..	..	..	8 13 11
600,070	London United Trams. (1901), 1 to 50,007	10	3 %	3 %	Nil	..	1⅜ — 2⅛	1⅜ — 2⅛	..	..	..	Nil
999,980	Do. do. 50,008 to 100,000	10	3 %	3 %	Nil	..	1⅜ — 2⅛	1⅜ — 2⅛	..	..	..	Nil
125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	5 %	5 %	3⅜ %	..	3 — 3½	2⅞ — 3	60/-	52/6	— ½	12 0 0
1,649,980	Do. do. 4 % 1st Mort. Deb. Stock	100	4 %	..	4 %	4 %	71 — 74	69 — 72	..	..	—2	5 11 1
5,722,062	Metropolitan Consolidated	100	1 %	½ %	1 %	1 %	44½ — 44⅝	43½ — 43⅝	44⅛	43⅝	—1	2 5 9
2,640,914	Do. Surplus Lands	100	2¾ %	2¾ %	2¾ %	2¾ %	67 — 69	67 — 69	67⅞	67	..	3 19 9
2,235,000	Do. District	100	Nil	Nil	Nil	Nil	23⅝ — 23¾	23⅝ — 23¾	23⅝	29⅞	— ½	Nil
321,337	Metropolitan Electric Trams., Ord.	1	..	..	4½ %	..	2 1/16 — 2 3/32 xd	2 1/16 — 2 3/32 xd	14/9	..	..	5 15 0
314,016	Do. do. Defd.	1	Nil	Nil	Nil	..	1/16 — 1/8	1/16 — 1/8	..	..	..	Nil
500,000	Do. do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	11/16 — 13/16	11/16 — 13/16	15/6	..	..	6 8 1
595,600	Do. do. 4½ % Deb. Stock Red.	100	4½ %	4½ %	4½ %	4½ %	97 —100	97 —100	99	98	..	4 10 0
$10,828,200	Mexico Trams Co., Common Stock	..	..	..	..	..	130½—132½ xd	129 —131 xd	..	..	—1½	..
$9,000,000	Do. 1st Mort. 50-year 5% Gld. Bds.	..	..	..	5 %	..	95 — 96	94½ — 95½	95⅞	95	+ ½	5 4 2
345,500	Potteries Electric Traction	1	4 %	4 %	Nil	..	1/16 — 3/16	1/16 — 3/16	..	..	..	..
345,500	Do. 5 % Cum. Pref.	1	5 %	5 %	5 %	5 %	1/16 — 3/16	1/16 — 3/16	..	..	..	6 17 11
345,000	Do. 4½ % Deb. Stock	100	4½ %	4½ %	4½ %	4½ %	84 — 87	84 — 87	..	..	..	5 3 6
87,350	Telegraph Construction and Maintenance	12	15 %	17½ %	15 %	17½ %	34 — 35½	34 — 35½	33⅛	..	..	5 16 0
140,000	Do. 4 % Deb. Bds., 1 to 1,500 Red., 1909	100	4 %	4 %	4 %	4 %	100 —102	100 —102	..	..	..	3 18 5
1,000,000	Underground Electric Railway, 5% Prior Lien	..	..	..	5 %	..	102½—103½	102½—103¼	103½	103	..	4 16 7
2,800,000	Do. do. 4½% Bonds	..	..	..	4½ %	4½%	89 — 91	89 — 91	90⅜	89½	..	4 18 4
4,900,000	Do. do. 6% Income Bonds	..	..	..	..	..	38 — 40	38 — 40	..	..	..	..
66,666	Willans & Robinson, 1 to 30,000 & 80,001 to 116,666	1	Nil	10 %	5 %	Nil	1/16 — 3/16	1/16 — 3/16	..	..	..	..
66,666	Do. 6 % C.P., 30,001 to 80,000 & 125,001 to 141,666	5	..	6 %	6 %	3 %	1½ — 2½	1½ — 2½	36/3	35/-	..	1 4 2
245,495	Do. % 1st Mort. Deb. Stock		4 %	4 %	4 %	4 %	68 — 73	68 — 73	..	..	..	5 9 7

ELECTRICITY SUPPLY COMPANIES.

15,000	Bromley (Kent) E.L. & P., 1 to 15,000	5	5⅛%	5⅛%	5⅛%	5⅛%	4½— 4⅝	4½— 4⅝	..	..	..	5 15 9
70,000	Do. do. 4½ % 1st. deb. stock	100	4½%	4½%	4½%	4½%	91 — 94	91 — 94	..	..	..	4 18 9
20,449	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	10%	10 %	10 %	10 %	7⅜ — 7⅝	7⅜ — 7⅝	7⅜	7 1/16	..	6 10 1
9,551	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	7 %	7 — 7½	7 — 7½	..	..	..	4 13 4
400,000	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	4 %	100 —103	100 —103	..	..	..	3 17 8
80,000	Charing Cross and Strand Electricity Supply	5	5 %	5 %	5 %	5 %	4 — 4½	4 — 4½	..	..	..	5 11 1
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	4½%	4½ — 4⅝	4½ — 4⅝	..	..	..	4 17 4
80,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	4½%	8¾ — 4⅝	8¾ — 4⅝	..	..	..	5 2 10
445,736	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	4 %	97 —100	97 —100	..	..	..	4 0 0
49,496	Chelsea Electricity Supply, Ord.	5	4½%	4½%	4½%	4½%	3⅝ — 4¼	3⅝ — 4¼	3/0/-	..	..	5 9 1
175,000	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	101 —103	101 —103	..	..	..	4 7 5
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	6 %	6 %	6 %	7 %	11½ — 12	11½ — 12	11⅞	11⅝	..	5 16 8
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	6 %	12 — 13	12 — 13	..	..	..	4 12 4
400,000	Do. 5 % Db. Stk.	Stock	5 %	5 %	5 %	5 %	121 —125	121 —125	124⅛	122⅛	..	4 0 0
300,000	Do. 4½ % 2nd. Db. Stk.	100	4½%	4½%	4½%	4½%	99 —102	99 —102	..	..	..	4 8 8
50,000	County of Durham Electrical Power, Ord.	5	4 %	2 %	Nil	Nil	1½ — 2	1½ — 2	..	..	..	5 0 0
50,000	Do. do. do. 5 % Pref.	5	5 %	5 %	5 %	5 %	2⅜ — 3½	2⅜ — 3½	..	..	..	7 13 10
250,000	Do. do. do. 5 % 1st Mtg. Deb.	Stock	..	..	5 %	5 %	94 — 96	94 — 96	..	..	..	5 4 2
40,000	County of London Electric Lighting, Ord. I—40,000	10	5 %	5 %	5 %	5 %	7⅜ — 8½	7⅛ — 8	7 5/16	7 1/16	— ½	6 5 0
55,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	6 %	10⅜ — 11½	10⅜ — 11½	11⅛	11 1/16	..	5 6 8
400,000	Do. do. 4½ % Deb. Stock	Stock	4½%	4½%	4½%	4½%	103 —106	103 —106	105	104½	..	4 4 11
400,000	Do. do. 4½ % 2nd. Deb. Stock	Stock	4½%	4½%	4½%	4½%	100 —103	100 —103	..	..	..	4 7 5
80,000	Edmundson's Electric Corporation, Ord. Shares	5	Nil	Nil	Nil	..	3/16 — 3/8	3/16 — 3/8	..	..	..	Nil
80,000	Do. do. 6 % Cum. Pref.	5	6 %	Nil	Nil	..	1½ — 1¾	1½ — 1¾	30/-	..	..	Nil
420,500	Do. do. 4½ % 1st Mort. Deb. Stk.	100	4½%	4½%	4½%	..	73 — 75	73 — 75	74	..	..	6 0 0
$8,150,000	Electrical Dev. Co. of Ontario, 5% 1st Mtg. Gold Bnds.	$500	..	..	5 %	5 %	83 — 86	82 — 85	83	..	—1	5 17 8
10,000	Folkestone, 1 to 10,000	5	5⅛%	5⅛%	5⅛%	5⅛%	4½ — 4⅝ xd	4½ — 4⅝	..	..	..	5 15 9
10,000	Do. 5 % Cum. Pref., 1 to 10,000	5	5 %	5 %	5 %	5 %	4⅝ — 5⅛ xd	4⅝ — 5⅛	..	..	..	4 15 3
90,000	Do. 4½ % 1st Deb. Stock	100	4½%	4½%	4½%	4½%	93 — 96	93 — 96	..	..	..	4 13 9
15,000	Hove, 1 to 15,000	5	9 %	8¼%	8½%	8½%	7 — 7⅛ xd	7 — 7⅛	..	..	..	5 13 4
$1,876,000	Kaministiquia Power Co., 5 % Gold Bnds.	100	..	..	5 %	5 %	102½—104½	102½—104½	..	..	..	4 15 8
21,000	Kensington and Knightsbridge Electric Ord.	5	10 %	10 %	8 %	8 %	7 — 7⅛	7 — 7⅛	..	..	..	5 6 8
90,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	4 %	94½ — 96½	94½ — 96½	..	..	..	4 2 11
111,000	London Electric Supply Corporation, Limited, Ord.	3	4 %	2½ %	3 %	..	1⅝ — 2	1⅝ — 2	36/3	..	..	4 8 11
70,000	Do. do. 6 % Pref.	5	6 %	6 %	6 %	..	4⅜ — 5½	4⅜ — 5½	..	..	..	5 14 3
262,855	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4½%	4½%	4 %	4 %	92 — 94	92 — 94	92½	..	..	4 5 1
200,000	Metropolitan Electric Supply, 1 to 100,000	5	8 %	6½%	5 %	5 %	4 — 4½	4 — 4½	83/0	..	..	5 11 1
76,121	Do. 4½ % Cum. Pref. 1—71,106	5	4½%	4½%	4½%	4½%	4⅜ — 5	4⅜ — 5	..	..	..	4 10 0
225,000	Do. 4½ % 1st Mort. Deben. Stock	Stock	4½%	4½%	4½%	4½%	104 —107	104 —107	..	..	..	4 4 1
248,000	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	3½%	83 — 86	83 — 86	..	..	..	4 1 5
$6,000,000	Mexican Electric Light Co., 5% 1st Mtg. Gold Bnds	100	5 %	5 %	5 %	..	84½ — 85½	84½ — 85½	85½	85	..	5 16 8
13,585,000	Do. Light and Power Co., Ltd., Common	$100	..	..	3½%	..	80 — 82 xd	79 — 81 xd	81½	..	—1	4 6 5
$2,400,000	Do. do. 7% Cum. Pref. Stk.	Stock	..	..	7 %	7 %	103½—105½	103 —105	104½	104	— ½	6 13 4
12,000,000	Do. do. 5% 1st Mtg. Gold Bnds.	100	..	..	5 %	5 %	89⅞ — 90¾	89⅞ — 90¾	90⅝	89⅜	..	5 10 2
950,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	4½%	96⅜ — 98⅜	96⅜ — 98⅜	..	..	..	x 11 5
180,491	Newcastle-on-Tyne, 1 to 187,500	5	8 %	8 %	2½ %	..	4⅛ — 4⅜	4⅛ — 4⅜	..	..	..	2 15 0
187,500	Do. 5 % Pref., 1 to 187,500	5	5 %	5 %	5 %	5 %	4⅛ — 4⅜	4⅛ — 4⅜	..	..	..	5 2 7
126,500	North Metropolitan Electric Power Supply Co., 5 % Mortgages (Red.), Nos. 1 to 1,265	100	..	..	..	5 %	97 — 99 xd	97 — 99 xd	..	..	..	5 1 0
19,952	Notting Hill Electric Lighting	10	7½%	7½%	7 %	..	11⅜ — 12⅜	11⅜ — 12⅜	..	..	..	5 9 10
20,000	Oxford, 1 to 96 and 407 to 20,310	5	7 %	7 %	7 %	7 %	6⅜ — 7	6⅜ — 7	..	..	..	5 0 0
80,000	Do. 4 % Deb. Stock	100	4 %	4 %	4 %	4 %	94 — 97	94 — 97	..	..	..	4 2 6
119,694	River Plate Elcty. Co. Ord. Nos. 1 to 120,507	1	2½%	2 %	2 %	2 %	1⅜ — 2	1⅜ — 2	40/-	38/-	..	4 0 0
100,000	Do. do. 6% Non Cum. Pref. Nos. 1 to 100,000	1	6 %	6 %	6 %	6 %	1 29/32 — 1 31/32	1 29/32 — 1 31/32	..	..	..	4 16 0
200,000	Do. do. 5% Deb. Stk. Red.	100	5 %	5 %	5 %	5 %	103 —105	103 —105	..	..	..	4 15 3
40,000	St. James' and Pall Mall Electric Light, Ord.	5	10 %	10 %	10 %	10 %	8¾ — 9	8¾ — 9	..	..	..	5 13 8
80,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	7 %	6⅞ — 7⅛	6⅞ — 7⅛	..	..	..	5 7 8
150,000	Do. do. 5½ % Deb. Stock Red.	100	5½%	5½%	5½%	5½%	84 — 88	84 — 88	..	..	..	3 19 7
12,000	Smithfield Markets Electric Supply, Ord.	5	Nil	Nil	Nil	..	1⅜ — 2⅛	1⅜ — 2⅛	..	..	..	Nil
88,000	South London Electric Supply, Ord.	4	8 %	4 %	5 %	5 %	2⅜ — 3⅛	2⅜ — 3⅛	..	..	..	6 9 0
130,100	Do. do. 5 % 1st Mort. Deb.	100	..	..	5 %	5 %	100 —103	100 —103	101½	..	..	..
120,000	South Met. Elec. Lt. & Power, Ord.	1	2½%	2½%	2½%	..	1/16 — 1/8	1/16 — 1/8	..	..	..	4 8 11
149,968	Do. do. 7 % Pref.	1	7 %	7 %	7 %	7 %	1 — 1⅛	1 — 1⅛	21/8	..	..	6 4 5
224,520	Do. do. 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	4½%	98 —101	98 —101	..	..	..	4 9 1
80,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	..	½ — 1	½ — 1	12/6	..	..	10 0 0
50,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	1½ — 2	1½ — 2	45/-	..	..	10 10 6
275,000	Do. do. 4½ % 1st Mort. Deb. Stk. Red.	100	4½%	4½%	4½%	4½%	79 — 81	79 — 81	15/-	..	..	5 11 1
808,000	Victoria Falls Power Co., Pref. Nos. 1 to 808,000	1	..	..	5 %	..	2/32 — 3/32	2/32 — 3/32	..	..	..	6 6 8
100,00	Westminster Electric Supply, Ord.	5	12 %	10 %	10 %	10 %	8½ — 9	8½ — 9	8 5/8	8 1/4	..	5 11 1
51,979	Do. do. 4½ % Cum. Pref. Reduced from 5% since 31st Dec., 1905)	5	4½%	4½%	4½%	4½%	5 — 5⅛	5 — 5⅛	5⅛	..	..	4 1 10

* Unless otherwise stated, all shares are fully paid. † Quotations on Liverpool Stock Exchange.

Bank rate of Discount 4 per cent.. March 17th. 1910.

PROCEEDINGS OF INSTITUTIONS.

Electric Drive in Textile Mills.

By Albert Milmow.

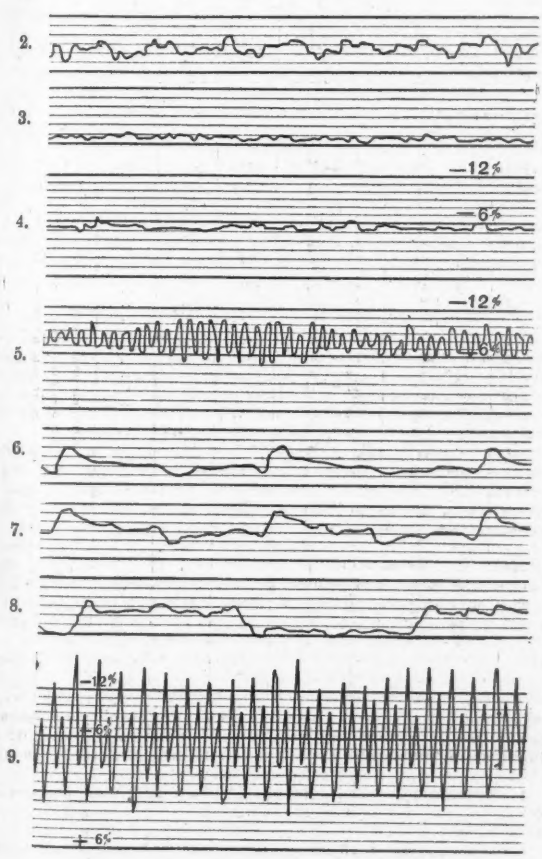
(*Abstract of paper read before the* American Institute of Electrical Engineers, *at Charlotte, U.S.A., March 30th*, 1910.)

(*Concluded from page* 620.)

Production.—In a mill which has perfect balance, each piece of machinery used in each process will deliver to the next succeeding department just the right amount of material to keep both sets of machinery operating at full output all the time, and so on until the completed article of manufacture is produced. This is a condition difficult to realise in actual service.

In equipping a mill for electric drive it is usual and proper to provide one or more motors for each process of the work, so that in case the demand on that department is increased, it is possible to work overtime on that particular department, where, on account of the inefficiency of the engine at light loads and often because of the very small part of its capacity that is required, it would be impossible to run with a steam drive; or if some department is not needed at all, the motor provided for it can be shut down entirely, saving all expense of its operation without affecting the operation of any other department or in any way affecting its speed.

These points are actually taken advantage of and practised to a very great extent. In mills using automatic looms, they are frequently left in operation at the noon hour, and they will run until some threads break, when the loom automatically stops itself and remains stopped until the weaver returns. Many of them continue in operation without interruption. In some cases looms are left in operation after shutting-down time until the loom stops itself, which often does not occur until all the filling yarn is exhausted. These hours in the aggregate sum up a very respectable total in the course of the year.



Figs. 2-9.—Speed Charts from Textile Machinery.

An interesting application illustrating the flexibility of electric drive has recently been made and is being quite generally followed. In this case a mill was built with a capital of £20,000 and with an equipment of 5,000 spindles for the production of yarns. It was the intention to operate this mill day and night, and the promotion of the mill was based on this idea. It was found, however, that for the spinning frames, which require women and girls to operate them, sufficiently satisfactory labour could not be obtained to operate during the night run, so that the management found itself in the position of being able to offer to its stockholders a production based only on the actual money employed, or £20,000 Through their own initiative they then took advantage of the opportunity offered by electric drive, and added to their equipment an amount of spinning machinery equal to that already installed. This operated with the rest of the equipment during the day time, and all preparatory machinery, for which only men were employed, was operated day and night, thus giving material to the double number of spinning frames during the day. This resulted in a production equal to that of a mill of 10,000 spindles costing £40,000, while the total cost of the mill was only £24,000. The addition of the extra spinning machinery cost £4,000, and the original cost of the mill was £20,000. This arrangement has, simply by the proper use of electric power, saved the mill an additional burden of investment of £16,000, the interest and depreciation on which would more than eliminate the entire power bill.

It has been found that in practically every mill that has been converted from mechanical to electric drive an increase in production has been obtained. This is almost always the case, though it is not usually taken account of by investigators of power costs. Among the uninformed there is a quite general opinion that the converted mill takes to operate it electrically as much as, or more, power than it previously did with steam. On account of the increased production with the electric drive, this is true in a great many cases; but in many other cases it is uncertain, as no accurate records of steam indications have been taken or kept. The explanation of this increase in power is simply that the production has been increased. At the time the motors are installed the speeds of the mill are readjusted and nearly always increased, the power is applied more directly to the work with less chance of slippage of belts and, above all, the speed with motor drive is much more constant.

Figs. 2 to 9 show a series of curves taken with a delicate recording tachometer. The longitudinal lines each represent 1 per cent. of instantaneous variation, and approximately ½-in. in length of the diagram shows an interval of time of one second. All of these charts shown were taken in actual service. A special one was taken to prove the accuracy of the instrument with the best known constant-speed drive—a direct-current shunt motor supplied with current from storage batteries.

Fig. 2 shows a chart from a 3,000-h.p. cross-compound engine, taken directly from the main driving shaft.

Fig. 3 is a chart taken directly from the shaft of a 125-h.p. motor.

Figs. 4 and 5 are of particular interest as showing the torsional spring in the shaft. This represents a line of shafting about 300 ft. long, such as is commonly found in weave rooms. Fig. 4 was taken at the driving end, and fig. 5 at the extreme other end, showing that where the original speed was excellent, it was badly perturbed before reaching the end of the shaft.

Figs. 6 to 8 show very badly perturbed speeds. These represent the three main line shafts on which the entire machinery of a large mill depends. This speed variation is caused by bad belting and excessive end play in the shafts, causing crowning and slackening of the belts alternately.

These curves show the insufficiency of counted speeds where instantaneous variation is neglected. The highest point of the curve shows the maximum at which the work will run, and all below that represents a loss of production. Fig. 9 illustrates an extremely bad speed condition of which the mill manager has been ignorant, and the mill has never been able to get out a good production.

In a converted mill, driven from a hydro-electric station, one of two results is always brought about. If the original production is maintained, the amount of power necessary is reduced. This should not in all cases be regarded as of paramount importance, the most vital advantage being an increased product from the mill, which it has been shown can be obtained through electric drive. This has actually been obtained in nearly every case that has come under my observation.

In mills only very roughly converted, where surplus power is taken, and where the old uneconomical arrangement is left intact so that the steam drive may be used when the electric power is temporarily shut off, all carefully kept records show that an increase of production of from 2 to 10 per cent. is obtained. In new mills especially constructed for electric drive the higher of these figures should obtain. This increase is brought about by two things: First, proper balancing of the work, and next, the application of motive power directly to the work it is to drive, and the fact that this motive power has a constant speed value, both instantaneously and continuously.

At first considerable prejudice existed among the mill owners and the underwriters against the use of high-voltage motors, but some years of experience have demonstrated their superiority in every way. The first cost is about equal to that of the lower-voltage motors. Their efficiency is equal, and the slip is also equal or somewhat less. With an equipment of 2,200-volt motors power can be transmitted with an economical loss and reasonable first cost to a distance of approximately one and one-half miles from the central sub-station.

In mills using 2,200-volt motors the wiring is run in iron or steel conduit, and consists of three-wire insulated cable with lead sheaths. The loss in this system is reduced to practically nothing, the cost is low, and complete protection is afforded by means of automatic oil switches. The size of the wires is very small, and the whole system takes up less space in a mill, and is no more conspicuous than water and sprinkler pipes. On account of grounding the conduit, the liability to accident is practically eliminated.

The manufacturers of standard motors now build 2,200-volt motors in sizes as low as 15 H.P., and where motors smaller than this are required, 2,200 to 550-volt transformers are installed on the mill wall close to the motors, and the secondary wire is run directly to the motors from them.

Electrical Equipment of Textile Mills.

In discussing the industrial power papers read at a joint meeting of the American Society of Mechanical Engineers and the American Institute of Electrical Engineers, in Boston, Mass., February 16th, Mr. N. W. Dalton gave some interesting facts on the practical operation of electrically equipped textile mills, based on conclusions derived from experience with induction motors in large plants. He contends that while in special cases individual drive may be installed, generally the group drive should be used in such mills. As few different sizes of motors should be employed as practicable, and a study of the possible grouping of machinery in the different mills will show that a few motor ratings will cover all cases.

Inasmuch as a large proportion of textile machinery is designed to be driven from slow running shafting, it follows that moderate-speed motors should be employed. Floor space is too valuable to devote any of it to motor and driving belt. Motors should, therefore, be inverted and bolted to the ceiling at truss line.

Grouping of machinery should be limited to 50 H.P. or 60 H.P., making motors weigh under two tons, for ease of handling. By limiting motor size one can get along with less repair apparatus, a great consideration in emergencies.

While smaller motors than the largest adopted are necessary, motors should in all cases be kept as near the largest size as possible. Smaller motors mean danger from overloading by shafting out of line, hot bearings, and other minor machine troubles. Such things are relatively unimportant in the larger sizes. Still, small sizes must be used for some kinds of machinery which consume very little power.

All efforts toward greater reliability will be well spent. The greatest cause of failure in induction motors lies in the starting devices. Immunity from delay is best secured by having the starting device entirely separate from the motor—preferably a voltage-reducing device in the motor leads. In case of failure this may be short-circuited and a temporary starter used until repairs may be executed without delaying production. When a starting device is located inside the rotating secondary, the matter of repairs may involve a considerable delay. In this limited space and with a machine exposed to dirt and careless usage, no system of sliding contacts can ever give satisfactory performance. The motor with internal starting resistance has a high starting torque with low starting current; the resistance of the secondary when up to speed is very low, thus giving the motor little slip. These are desirable characteristics, but are outweighed by the matter of reliability. The lack of reliability seems to be more in the operator than in the motor, for some of these motors run several years with no delays whatever.

The device almost always furnished for starting is an auto-transformer with double-throw switch. Mr. Dalton suggests that a cast-iron grid resistance would be simpler, cheaper and easier to install and repair. The starting position should be held by hand against spring pressure, so that the switch cannot be left in the starting position. With the oil-immersed switch it is best to have a lock so that the switch cannot be thrown to the running point until it is first drawn into the starting position.

For sizes of 100 H.P. or less, and voltages not over 600, air-break switches are the most satisfactory. Practically all the troubles of air-break switches are confined to burning of contacts and cutting in the hinge—minor troubles that are easily repaired. The switches must have a quick-break attachment. This, unless carefully designed, is apt to give trouble. It should be strong and not interfere with the operation of the main switch in case it gets into trouble. Carbon-break switches have not proved satisfactory.

Motors of the smaller sizes do not require any starting device, and may be thrown directly on the line. The limit of size to which this method of starting may be carried, depends on the connected machinery. Too sudden acceleration is destructive to belting. In general, textile machinery is disconnected from the shaft while the motor is accelerating, so that the starting torque required is light.

The second greatest cause of motor failure is due to bearing troubles. Babbitt metal is used for bearings, except in smaller sizes, where bronze is sometimes employed. Experience with bronze demonstrates that it is very unsatisfactory. Where babbitt is used, the air-gap should be sufficient to allow for the starting of the metal and plenty of smoke before the rotor can strike the stator. Smoke will attract the attention of the attendant, and the motor be stopped before the laminations strike. Motors should be capable of carrying reasonable overloads, and the behaviour of those overloaded should be watched to ascertain the effect on temperature.

Ventilating slots through the iron laminations of motors are useless in textile work, as they are promptly plugged by flyings. The cleaning of a hundred or more motors is no small task, and if left for nights and Sundays will not be done. The rotating parts should be so designed that the air blast will clean them when the motor is working. The bearing on the pulley end of the motor should also be designed so that it may be replaced in case of failure without necessitating the removal of the pulley. Pulleys have a way of rusting fast to the shaft and requiring some time to effect their removal. On some of the smaller motors an opposite effect has been noted; the pulleys work and destroy the key-seat in the shaft. A more liberal design of shaft and key is needed. If paper pulleys are used, they should have metal hubs. The variety having a piece of metal inserted to hold the key, will not stand up in hard service.

The lighting hours are few in the year, but the lighting must be ample.

In calculations for lighting, a certain, or rather uncertain, factor is introduced by the character of the flyings that collect on the lamps. In a spinning-room, for instance, the wool flyings are easily cleaned from the lamps, and full illuminating power is secured. Where the flyings carry certain amounts of dyestuffs and starch, allowance must be made, as the labour of cleaning and inconvenience caused thereby amounts to more than the excess cost of energy necessary to bring the lighting up to standard.—*Electrical World.*

The Faraday Society.

The Electrical Theory of Dyeing.

A very interesting discussion on this subject took place before the Faraday Society on April 5th, arising out of papers which were read by Mr. W. P. Dreeper on "The Nature of the Action of Dyeing," and Prof. W. W. Haldane Gee and Mr. W. Harrison on "The Electrical Theory of Dyeing." The theory put forward by Prof. Gee and Mr. Harrison is based on the fact that any two bodies placed in contact become oppositely electrified. Thus it can be shown that wool and silk in contact with water become negatively electrified, and hence wool or silk which are "wet out" before entering the dye vat must be negatively charged. It is further assumed, based on experiments by Pelet-Jolivet and Wild, and Knecht and Batey, that dyeing solutions are electrolytes, and that at the dilutions common in practice, ionisation is fairly complete. Take the case now of a basic dye: Its solution will contain small negative and large positive organic-free ions, and these latter will consequently be attracted by the negatively electrified fibres and fixed by some process not properly understood. In the case of an acid dye, which contains small positive and large negative ions, acid has first to be added to the bath, and the effect of this, according to the authors' experiments, is to give a positive charge to the fibre, which thus attracts the free negative ions, the positive forming a salt in the vat. Many dyeing phenomena are quoted which are easily and naturally explained by the electrical theory, and it is noteworthy that the ionising liquids are those which produce strong electrification by contact, and it is only in these liquids that dyeing is possible. In "dry dyeing," alcohol or aqueous alcohol—both ionising liquids—are employed, while benzole, a poor ioniser, can only be used for dyeing when water is present. On the other hand, the complete removal of dye from a fabric can only be effected by ionising liquids; benzene will not extract picric acid from wool, alcohol will. An interesting confirmation of the theory is afforded by the temperature experiments of the authors. These show that the contact potential difference between cotton, wool, and silk and water reaches a maximum at 40° C., falling again to a minimum at about 80°. With basic colours, the maximum amount of dye stuff is absorbed at 40° and the minimum at 80°. On the other hand, Mr. Dreeper (who also read a paper "On the Nature of the Action of Dyeing") quoted instances where the maximum point of fixation is about 95° C. Dr. Veley pointed out, with reference to these temperature variations, that many physico-physiological effects reach a maximum at 40°, and then rapidly diminish in intensity, such as the rate of evolution of carbon dioxide from seeds and flowers, the assimilation of carbon dioxide by leaves, the contractility of isolated muscle, and the coagulation of a protein.

The experimental portion of Prof. Gee's and Mr. Harrison's work, namely, the measurements of the charges on the dye stuff particles in suspension and in colloidal solution, and of the contact potential differences between the fibres and water, appears to have been carried out with great care and skill. These measurements, of course, could not be made directly, as the particles concerned with are non-conducting. The P.D.'s were therefore calculated on the basis of Helmholtz's theory of the electrical relation of a liquid and a porous diaphragm through which the liquid is passing. This may be done in four different ways:—

1. By measuring the rate of flow of the liquid through a diaphragm of the substance under electrical stress (electrical endosmose).

2. By measuring the mechanical pressure obtained by electrical endosmose.

3. By determining the speed of the solid in the form of small particles when immersed in the liquid under electrical stress.

4. By measuring the difference of electrical pressure between the two sides of a diaphragm when the liquid is filtered under mechanical pressure.

Method 3 was found to be most suitable when the particles are in colloidal suspension. The colloidal solution is introduced into the bend of a U tube, pure water being in the upper part of the limbs of the tube. Electrodes are introduced into the ends of the tubes, and the differences of level of the colloidal solution read on a mm. scale after the electrodes have been connected for some time with a supply voltage. Then the contact P.D. between the solid in suspension and the liquid is given by the expression—

$$\frac{4\pi}{\kappa}\,\eta\,\frac{v}{H},$$

where κ is the dielectric constant, η the coefficient of viscosity, v the rate of liquid flow, and H the strength of the electric field.

Alternatively, the direct movement of the particles was observed in the ultra-microscope, by the method of dark-ground illumination.

The results of these experiments showed, as indicated at the beginning of this article, that in water all basic substances are positive, the hydrochlorides of basic dyes positive, all acid substances negative, and most neutral substances negative. The speed of the particles under electric stress was of the order 20×10^{-5} cm. per sec. per volt per cm. Negative particles attained their maximum speed at about 45° C.

The contact P.D. between fibres and water was measured by method 4, filtration under pressure, and the values were found to be approximately as follows:—

Cotton	0·06 volt
Silk	0·12 volt
Wool	0·90 volt

As already stated, these P.D.'s reached a maximum at 40° C. Mr. Dreeper, however, pointed out that the order of the P.D.'s is not that of the relative dyeing powers of the above fabrics, as silks dye faster than wool. Wool, moreover, would be very incompletely dyed at 40° C.

On the whole, it is probable, and this was the general feeling of the meeting, that the electrical theory explains the initial attraction between the dye and the fibre, explaining how one type of colouring matter is selected in preference to another by the fabric, but it does not explain the ultimate fixing of the dye stuff. Whether this is purely mechanical—namely, an example of cohesion—or is a result of colloidal precipitation with the formation of aggregates of a complex character cannot as yet be decided, but the subject is one of great interest from many points of view; it is to be hoped that the discussion of it will have the effect of stimulating further research.

The Physical Properties of Switch and Transformer Oils.

By W. Pollard Digby, A.M.I.E.E., and D. B. Mellis.

(Abstract of paper read before the Institution of Electrical Engineers *at* Manchester, *March 22nd*, 1910.)

The bulk of the contents of this paper represents the fruit of investigations extending over many months, which were initially undertaken for the sole purpose of acquiring knowledge as to the electrical properties of these oils in general, and the respective merits of well-known brands in common use.

It is with the object of urging the systematic examination of oil before use, as well as suggesting standardised methods of testing, that the authors now put forward their account of some of the investigations which they have undertaken of some of the physical and chemical changes occurring through use. While they consider that even the makers of the best oils fail every day to maintain a standard quality of excellence, they consider the electrical engineer to be equally to blame for not having insisted on uniformity of quality.

Impurities ordinarily present in the oils supplied for use for oil-break switchgear or for transformers fall under the following heads:—Moisture; alkaline substances; resinous or resinoid matter; acids; sulphur compounds.

Their presence may be due to improper or inadequate refining, or to wilful adulteration, or to accidental contamination.

In storage the oil may undergo certain chemical changes. An alkaline oil would be likely to absorb moisture from the atmosphere, which would lower both its dielectric strength and its specific resistance. An oil stored or transported in wooden barrels might be contaminated by resinoid substances.

During use in oil-break switchgear, chemical and physical changes occur. These include the absorption of moisture from the atmosphere, the carbonisation of the oil, increases in specific gravity and in viscosity and changes in flash point. Also dust finds its way into the oil tank, while the effect of the arc which is broken on opening the switch is to produce decomposition and a gradual change in the properties of the oil. When used in transformers the absorption of vegetable oils from varnishes, nominally but not actually oil resisting, is probably the most prolific of the sources of trouble. Dust, in this instance, also finds its way into the oil, and either or both of these foreign matters render the oil more viscous, and restrict or reduce its circulation; further, through electrostatic attraction, dust adheres to windings and core, interfering with the heat transfer in much the same manner that scale limits the transmission of heat through boiler plates.

Of the properties requisite in a mineral oil for transformers the authors would urge:—(1) Absence of moisture; (2) good dielectric strength; (3) a low viscosity to facilitate the heat transfer from the core and windings to the case; (4) a flash-point expressed by a figure which is two to three times the designed temperature limit of the transformers in ° C.; (5) an absolutely neutral reaction; (6) complete absence of vegetable oils or resinoid material; (7) freedom from metallic salts.

For switchgear the authors would emphasise the need of points 1, 2, 5, 6 and 7. Viscosity is discussed later, and the flash point might be at least six times the expected engine room temperature.

For the measurement of specific resistance the authors have mainly employed horizontal test-plates with areas of 100 or 200 sq. cm. The apparatus employed consists primarily of two metal disks of even surface arranged parallel to, but insulated from, one another, the distance between them being regulated by a micrometer head. Readings were taken with a Megger or other form of ohmmeter, gradually reducing the distance between the test-plates. The readings must always be taken in a descending order of values for insulation and of film thickness, as when once sparking takes place the specific resistance of the liquid is altered and lower values result.

A series of six special samples of oil, each from a separate maker, was obtained for comparative examination. Fig. 1 illustrates the behaviour on dielectric test of one of these oils as received from the manufacturer. The apparatus used is illustrated in fig. 2. The following table sets out their physical properties as received:—

Sample No.	Disruptive voltage at 100 mils.	Specific resistance per cm.³ megohms.	Specific gravity.	Viscosity.	Flash-point °C.	Chemical properties—Colour.	Chemical properties—Reaction.	Chemical properties—Resinoid matter.
H 1	11,000	Over 6,500,000	0·8563	27 63	176 2	Light brown	Neutral	None (?)
H 2	8,750	666,416	0·8634	44·09	168·5	Full lemon	Neutral	Considerable
H 3	11,250	6,500,000	0·9030	87 98	181·0	Light sherry	Faintly alkaline	Moderate
H 4	10,250	(?)	0·9116	414·00	179 0	Dark red brown	Slightly alkaline	Very much
H 5	10,250	1,864,000	0·8936	56 20	180 0	Red brown	Slightly acid	None
H 6	8,000	1,541,000	0·8986	38 80	181·2	Full lemon	Slightly alkaline	None (?)

In testing oils for dielectric strengths, the apparatus employed should embody the following features:—(1) The quantity of oil required to make a set of tests should be as small as possible; (2) the electrodes should be readily interchangeable, so that various shapes can be fitted as desired; (3) the distance between the electrodes should be easily and accurately adjustable to any desired value; (4) it should be an easy matter to clean both containing

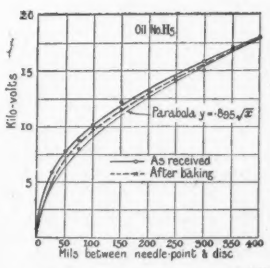


Fig. 1.

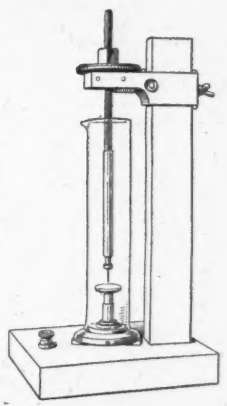


Fig. 2.

vessel and terminals after a set of tests, so that there will be no danger of contamination of the next oil to be examined. The apparatus illustrated in fig. 2 complies with these requirements fairly well. The shape of the electrodes influences the value of puncturing voltage which will be found over a given distance, and in making comparative tests with different samples of oil it is advisable to choose the terminals which give—

1. The lowest possible puncturing voltage over a given distance, for this is the limit of what might be expected in actual practice; and—

2. The most consistent set of results with any one oil.

It is found that with one, or both, electrodes pointed, the second of these conditions is complied with, while with electrodes consisting of a point and disk respectively, the first condition is complied with. In fig. 3 the lower full-line curve shows the relation between puncturing voltage and distance when testing between a point and disk; the experimental points obtained lie with considerable consistency on a smooth curve. The upper full-line curve was deduced from the lower one, by taking for each ordinate double the ordinate of the lower curve at half the sparking distance, and should represent the relation between voltage and sparking distance when testing between two pointed electrodes. The actual points obtained by experiment between two needle-points are indicated in the paper by three-legged stars, and it will be seen that they follow very closely the theoretical curve. The points indicated by the squares were obtained by testing between two $\frac{3}{4}$-in. balls, and it will be seen that not only are the figures obtained much more erratic than before, but that the law which they obey is totally different, and approximates to a straight line law, as indicated by the dotted line. The points indicated by the four-legged stars were obtained by using as electrodes a $\frac{3}{4}$-in. ball and a disk, and, again, as we should expect, the figures are on the whole slightly lower than those obtained between two balls. From consideration of the electrostatic fields between different shaped electrodes, as verified by the experiments just described, we see that the lowest puncturing voltages will be obtained over reasonable distances when a point and disk are used, and as this arrangement also gives consistent readings, we adopted it for our tests. After each puncture the end of the needle-point used is fused and destroyed, so that it is necessary to fit a new needle for each reading.

Also, at each puncture a certain amount of oil is decomposed, carbon being thrown down and gas escaping. After a number of punctures have been taken on the same sample of oil it becomes quite black with the carbon in suspension, and it may be argued that it is not fair to the oil to go on making further tests on its dielectric strength after it has reached this condition. We accordingly made tests to discover how much, if at all, the oil deteriorated, and found, contrary to what might have been surmised, that even after the oil was as black as ink its dielectric

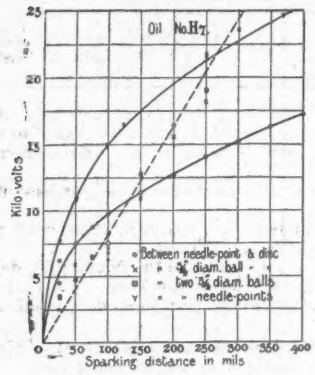


Fig. 3.

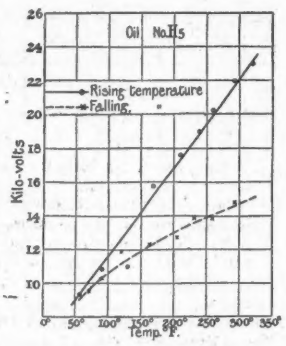


Fig. 4.

strength had not appreciably weakened. In fact, we frequently found that after a puncture or two the dielectric strength improved, probably due to some slight impurities being burned out.

After 32 punctures the oil was certainly not weaker through carbonisation than it was at the beginning, and very consistent results were obtained for about a dozen punctures.

The oils furnishing the series of samples H 1 to H 6 were then baked for 24 hours at a temperature of 240° F., and after cooling were again tested.

The following table sets out their change in physical properties after baking, increases being indicated (+) and decreases (—).

The two points of outstanding interest are the increases in the disruptive voltage in four out of the six cases, and the pronounced darkening of the colour in each case.

Sample No.	Disruptive voltage at 100 mils.	Specific resistance. Ω	Specific gravity.	Viscosity.	Flash-point. °C.	Chemical properties— Colour change.	Reaction.	Resinoid matter.
H 1	— 650	Unchanged	+0·0087	+ 0·17	—17·7	Light lemon to medium sherry	Very faintly alkaline	Slight
H 2	+1,250	+1,176,900	—0·0021	+ 3·41	+25·5	Full lemon to light sherry	Neutral	Moderate
H 3	+ 500	—3,828,500	+0·0028	+ 2·72	+17	Light sherry to dark olive brown	Distinctly alkaline	Moderate
H 4	+1,000	Decrease: extent not determined.	+0·0052	+33·70	+19·5	Dark red brown to very dark olive brown	Slightly acid	Considerable
H 5	—1,000	—1,013,300	+0·0011	+10·35	+23·25	Red to very dark olive brown	Very slightly acid	None
H 6	+3,000	+886,030	—0·0006	+ 3·90	+ 4·5	Full lemon to dark olive brown	Neutral	Moderate

Reviewing the effect of baking this series of oils, we have the following general deductions:—

1. An increase in the disruptive voltage where this was less than 10 000 volts over the test distance.

2. No increase in specific resistance for oils of high specific resistance, but an increase of specific resistance in those cases where decreases in specific gravity indicate the expulsion of moisture.

3. A general increase in specific gravity and viscosity, and a raising of the flash-point, due to the evaporation of the more volatile constituents.

4. Marked changes in the colour of the oil, in each case of a darkening nature. This is probably due to the evaporation mentioned above, coupled with molecular regroupings of the constituents.

5. A tendency to emphasise the indications of any traces of alkali, the change being from neutral to very faintly, or from faintly to distinctly alkaline.

6. Irregular behaviour in regard to the indications of the presence of resinoid matter. This varies with the nature of the oil, and is probably worth further investigation.

The physical examination comprises determinations of the specific gravity, the viscosity, the flashing-point or temperature at which the oil gives off an inflammable vapour, the specific electric resistance and dielectric strength. A very satisfactory method of determining the specific gravity is afforded by the Westphal balance.

The viscosity is best ascertained by the Redwood viscosimeter. The flashing-point is best ascertained by some such apparatus as the Martin-Pensky.

The coefficient of expansion of petroleum varies inversely as the specific gravity. A. H. Allen gives the following figures:—

Specific gravity at 15° C.	Expansion coefficient for 1° C.
Under 0·700	0·00090
0·700 to 0·750	0·00085
0·750 to 0·800	0·00080
0·800 to 0·815	0·00070
Over 0·815	0·00065

The oil should be pure mineral oil, free from moisture or any notable proportion of oils of low boiling point, alkali, acid, sulphur and its compounds, resin, fatty oils, tarry matter and metallic soaps. Colour is not always an index of quality. A dark-coloured oil may be quite pure, but is less likely to be so than an oil of a golden shade. Fluorescence is a usual characteristic of most mineral oils, but is entirely absent in some. Odour, cold or on warming, if pronounced, indicates imperfect refining or undesirable volatile compounds. Turbidity may be caused by the presence of water or of solid hydrocarbon bodies. In the first case, frothing generally ensues on heating; and in the other, solution would take place. Turbidity may also arise from suspension of insoluble solid matter. Moisture may be detected by means of exsiccated cupric sulphate, which is coloured blue by the slightest trace of water. The rough-and-ready test by immersion of a strongly heated bar of metal is also useful. The amount of moisture and oils of low boiling point is determined by the loss of weight at 100° C. First-class oils rarely show a greater loss than 0·3 per cent. in 6 hours; and when the figure exceeds 0·5 per cent., the flashing point or the specific resistance may be low.

Alkali and acid, if present, are found by shaking the oil with an equal bulk of boiling water in a separator or a closed tube, which is then maintained at a temperature of 98° C. to 100° C. until separation is complete, when the aqueous liquid is tested with suitable indicators. Phenol-phthalein is not reliable, and is not affected by the soaps of alkali metals; whilst methyl-orange cannot be used with hot liquids. Tincture of cochineal prepared with 20 per cent. of alcohol is most generally suitable. In neutral solutions its colour is red; alkali produces a violet purple, and acid gives a yellow colour. When used with due care, it is very sensitive. Alkali (soda) is also indicated by the production of a milky white emulsion; whilst resin is precipitated in fine, white granules, which form a well-defined band at the point of separation of the oil from the water. A. H. Allen, in his "Commercial Organic Analysis," states that "alkali is often purposely left in an oil with the view of increasing its 'body' or viscosity! This is effected by blowing air through the imperfectly washed oil. As the moisture is got rid of the oil takes up the soda while remaining perfectly transparent. Such oil is very prone to oxidise, and becomes turbid on exposure to air from absorption of moisture. It is also liable to change in colour." The authors have found that slight traces of alkali are liable to cause deterioration in the specific resistance in consequence of absorption of moisture.

A portion of the separated water used to extract acid and alkali is tested for sulphuric acid and sulphonates, by the addition of a solution of baric chloride.

Sulphur may be identified by applying the nitro-prusside test to an aqueous extract separated after the oil has been subjected to the action of metallic sodium. The slightest trace of sulphur gives an intense violet-blue colour. This test should not be attempted by those who have not had a chemical training. Sulphur compounds give a brown colour on the addition of silver nitrate to a slightly ammoniacal extract from a heated mixture of the oil with alcohol. Fatty oils and resin are indicated by the acrid or resinous odour given off when the oil is heated until its vapour ignites and the flame blown out. The fatty oils are definitely detected and their amount estimated by saponifying the oil, washing the aqueous soap solution with ether, and separating the fatty acids. Resin may be approximately estimated by agitating the oil with fairly strong alcohol, which is then separated and evaporated to dryness. Resin gives a brown colour to caustic soda. If the oil contains tarry matter, it is detected by agitating the oil with an equal volume of solution of caustic soda of specific gravity 1·36 and separating at 55° C. The tar, &c., will be precipitated.

Mineral impurities and additions will be found in the ash left on ignition of the oil. Alkali-metal soaps leave an ash having a strong alkaline reaction; and any free fixed alkali (soda) existing in the oil would give a similar result. Oleate and palmitate of aluminium are occasionally added to mineral oils to increase the viscosity; and the ash from such oil contains oxide of aluminium in sufficient quantity to give proof of the presence of aluminium. Aluminium soap may also be found by extracting the oil with ether and dilute acid. The addition of ammonia to the separated and filtered aqueous liquid gives the characteristic precipitate of aluminium hydrate.

The fact of the variation of specific resistance with temperature suggested to the authors the advisability of studying the relation between temperature and dielectric strength. For this purpose the needle-point and disk were set at a distance of 100 mils and the temperature gradually raised to about 300° F. The time occupied in heating was about one hour. The temperature was then allowed to fall, an operation taking about the same time. The dielectric strength was tested during both the heating and cooling periods. In only two out of the six cases were points given on cooling identical with the heating curve. In these two cases the specific resistance of the oil as supplied was very high indeed. Fig. 4 gives an example of the results.

It is obvious from these tests that for all oils the dielectric strength increases with increasing temperature, but that consistent readings on the ascending and descending temperature curves are only obtained by oils of high specific resistance, *i.e.*, pure oils. This fact of increase of dielectric strength with temperature throws a grave doubt on the soundness of the general practice of nearly

all makers of oil-cooled transformers, who apply lower test pressures to the transformer when heated at the end of a test run, than when it has been allowed to cool down.

The "body" or viscosity of oils is very materially affected by variation of temperature. The specific gravity of an oil is quite valueless as an index of its viscosity. The viscosity of Russian mineral oils is greater than that of American mineral oils of the same specific gravity; and for equal increments of temperature the viscosity of the Russian oils falls to a greater extent than that of the American oils.

(To be concluded.)

PARLIAMENTARY.

Bradford Corporation Bill.

A Select Committee of the House of Commons, presided over by Mr. C. N. Nicholson, considered the Bill promoted by the Bradford Corporation last week. Mr. H. Lloyd, K.C., and Mr. W. J. Jeeves, appeared for the Corporation; Mr. Balfour Browne, K.C., and Mr. Blennerhassett, K.C., represented the Great Northern Railway; Mr. Talbot, K.C., and Mr. J. Shaw, the Midland Railway Co.; and Mr. Erskine Pollock, K.C., the Bradford carriers and cab proprietors.

Mr. Lloyd, K.C., in opening for the promoters, explained the various proposals relating to street and tramway works, &c. The tramway clauses related to the construction of various new lines, and Parliament were also being asked to sanction trackless cars, whilst there was also a proposal to carry goods and minerals on the tramways. Four new tramways were contemplated. It was towards the proposal for the railless system of traction that the opposition was directed. There were no instances of the trackless system in this country, but he urged that this was no reason for condemning it. Deputations had visited Germany, Austria and Italy, and had found some 20 or more installations of this type. The capital cost was from 20 to 25 per cent. of that of tramway construction. Bradford were asking for general powers with regard to the system, and no routes were at present specified, but it was asked that the routes should be subject to the sanction of the Board of Trade. As to the actual running cost, the saving would be only about a 1d. per mile, and the main economy was in the capital charges. The Midland Railway Co. alleged unfair competition, but the railways would participate in the benefit of a reduction in the rates. As to the point that such wide powers ought not to be granted, he contended that the object of the promoters was to provide for the needs of the public in an economical manner, and it would be far too costly a proceeding if they had to come to Parliament for every application. Dealing with the opposition of the carriers, Counsel pointed out that already the Corporation had powers to carry goods on some of their tramways.

Mr. C. J. Spencer, manager of the City tramways department, gave evidence, and said that the Bradford tramways system composed 54¾ route miles and 99 miles of single track, 5½ route miles being outside the City boundary. Witness proceeded to describe the route on which it was intended to install the system, which would mean the linking up of Brighouse and Bradford. Powers for the construction of a line to link up these places were obtained in 1901, but had not been carried out. He was one of the deputation which went abroad, and at Vienna they saw a very interesting trackless route, running through a sparsely populated district in connection with an ordinary rail route. The cars were steerable on all parts of the road. The system had been working for about a year, and the municipality of Vienna was well satisfied with it. At Milan they inspected a very heavy and hilly route from the shores of Lake Como, with gradients as steep as 1 in 8. The system was not regarded in any way as experimental, and the Italian Government had given the contract for the mails to be carried on it. Of all the systems they inspected, he did not consider there was one failure. He estimated that the capital cost of establishing a railless system in Bradford would be from £1,000 to £2,000 a mile as compared with £13,000, the cost of constructing an ordinary rail route. The vehicles would have a capacity for 24 passengers, and the weight would be from 4¼ to 4½ tons. This would be about half the size, weight and carrying capacity of an ordinary tramcar. Taking the Sticker Lane route of one mile and a half, he estimated that the cost of equipment would be £1,875, and the cost of five cars at £850 each would be £4,250, or a total of £6,125. He estimated an annual income of £4,000, which would give a profit of £1,500. He had not calculated the cost of keeping up the roads, in view of the fact that the Corporation would pay rates and taxes on the route.

In further examination, Witness said the Corporation now dealt with 700,000 parcels a year on the tramway system.

The Chairman asked if it were not somewhat unusual to ask for power to carry goods and minerals over the whole system.

Mr. Jeeves said the Corporation already possessed powers to do this on certain of their lines.

Witness said he believed it was the intention of the Corporation to develop the traffic in heavy goods. So far it had been impossible to put their full powers in operation, because they did not apply to all parts of the route. There were many mills and factories not directly served by the railways, and enormous quantities of coal had to be carried by horse-drawn vehicles, and the Corporation felt that they could deal with this class of traffic both to their own advantage and to that of the mill-owners. At Huddersfield such traffic had been developed.

Cross-examined by Mr. Pollock, Witness said that in Huddersfield the mill-owners provided their own sidings. He had not seen the carriage of heavy goods by the railless system, but he had been told that goods were carried.

After discussion between counsel, Mr. Jeeves said the reference in the Bill to mechanically propelled vehicles was intended to refer to omnibuses, and he proposed to submit another clause dealing with the matter.

The Chairman asked if that meant that the promoters were now only asking the Committee for power to carry goods on the tramway and railless trolley routes only.

Mr. Jeeves assented to this proposition.

Witness was further cross-examined as to whether the Corporation had not carried goods by motor-car not only in Bradford but to Huddersfield and Leeds, and said he could not recall it. Last year the cost of their parcels traffic was £6,322 and the net surplus £1,028.

In reply to the Chairman, Witness said that the great bulk of the parcels were carried on the tramways, but with regard to a small portion, it was found convenient to collect and deliver them by motor-cars.

The Chairman asked where the sanction for the purchase of motor-cars came in.

Mr. Jeeves admitted that there was no direct sanction, but the Corporation felt it was necessary for the purpose.

Mr. W. F. Marwood, assistant secretary to the Board of Trade, said that in no case had power been left to the Board of Trade to prescribe a tramway route, except with regard to short connecting lines.

After local evidence had been called as to the need of tramways in certain districts,

Col. Yorke, of the Board of Trade, was examined by the Chairman as to the regulations and practices of the Board of Trade relating to the selection of routes suitable for tramways, and he said there was no definitely fixed rule on the point. In an extension of any magnitude, he took it, it would be necessary to bring a Bill before Parliament. The general result of a consultation which had taken place with reference to this Bill was that general powers were to be sought, which, however, should only be exercised by permission of the Board of Trade. This, of course, was with reference to the railless system only, and not for an ordinary tramway. He considered it would be a sufficient safeguard for the general public if an inquiry were held locally into applications of this kind by the Board of Trade, subject, perhaps, to an appeal to Parliament.

Mr. A. R. Fearnley, manager of the Sheffield Corporation tramways; Mr. McElroy, manager of the Manchester City tramways; and Mr. J. B. Hamilton, manager of the Leeds Corporation tramways, also gave evidence.

This closed the case for the promoters, and a number of witnesses engaged in the carrier trade of the city were called by the opposition.

Having heard counsel on both sides, the Committee reserved their decision.

On the Committee resuming, Mr. C. J. Spencer was recalled, and described the operation of the parcels department of the tramways. He stated that the average amount received per parcel was 3·36d., and the minimum amount 1½d., although they held themselves open to charge a lower rate. He had found that some years ago the Corporation did run some goods to Huddersfield, but the practice at present was for goods for districts outside the area to be handed over to local carriers and other tramway systems. At least 95 per cent. of the parcels dealt with went by tram.

The Committee consulted together for a considerable time in private, and, on the resumption of the proceedings, the Chairman said they regarded the matter as of considerable importance, as this was the first experiment with the trackless trolley system in the country. The Committee approved of the principle of the trackless trolley system along Laisterdyke and Sticker Lane, but that did not imply that they were giving sanction for a tramway. This was merely to be an experiment of the railless system. Generally speaking, the Committee approved of the experiments in Bradford, but with regard to any future extensions of such a system, they agreed that it should be made only by provisional order to be made under the sanction of the Board of Trade, and further, any possible conversion of the trackless trolley into a permanent tramway must similarly be made by provisional order. The Committee had come to the conclusion that they could not extend the powers of the Corporation to carry heavy goods traffic either on the tramways or the trackless trolley system. As to how far the Corporation were at present empowered to carry heavy goods for inter-departmental purposes was a moot point, and for the present the Committee would reserve their decision on that. As to parcels, they thought the weight to be carried should be limited to 56 lb., and that no parcel should be carried outside the limits of the city. The Committee also thought it would be well if the accounts of the new system were kept distinct from those of the general tramway undertaking, because, if further applications were made by other authorities, they would like to have the experience of Bradford before them. Further, they thought the accounts of the parcels department should be kept separate.

Mr. Lloyd said he took it that the Corporation could also proceed by private Bill for extension of the system.

The Chairman intimated that this was meant.

At a later stage the point of the carriage of heavy goods was again raised by Mr. Jeeves, and the Chairman stated that it was not the idea of the Committee to take away any powers which the Corporation now possessed. All they had agreed was that the powers should not be extended. They gave the Corporation power to carry parcels up to 56 lb. over the whole tramway system.

The Committee afterwards passed several clauses for the extension of the existing tramways, and proceeded to deal with other proposals in the Bill relating to markets, gas works, &c.

Rhondda Urban District Council (Tramways Extensions, &c.) Bill.

The Local Legislation Committee of the House of Commons, presided over by Sir F. Layland Barratt, on Tuesday last week, commenced the consideration of the above Bill.

Mr. Freeman, K.C., in explaining the Bill, said that in 1902 the Council obtained a Bill authorising the construction of tramways, and in that measure a clause was inserted providing that the tramways could be constructed by, or leased to, a company. The Council accordingly entered into negotiations with a syndicate known as the Tramways Development Co., who were the trustees for another tramway company. After considerable negotiations it was agreed that the company should construct certain parts of the tramways as they decided upon, and that they should pay to the Council £2,250 a year. The Council were to have the power of purchasing the tramways under Sec. 43 of the Act of 1870. There was, however, a proviso that the sum payable should not exceed the total amount of the rent paid during the 42 years, plus 3½ per cent. compound interest. The company thereupon constructed the tramways, but they left out two short pieces which were authorised by the 1902 Act. In 1905 a Bill was presented for the extending of the period for acquiring land and constructing the tramways. The Council, however, were only successful in getting an extension of time. The lines were opened in November, 1908, and the first year's working had proved very remarkable. There was a profit, after paying the working expenses, of £22,419. The result of the opening of the tramways was that there was immediate pressure brought to bear on the Council to extend the service. The Council thereupon after due consideration decided to apply to Parliament for powers to extend the line from Treherbert to Tynewydd, and between Ferndale and Maerdy. These proposals were in the 1902 Bill, but the company did not construct them under the optional powers which they possessed. The Council also proposed to construct an altogether new line from Pen-y-Graig to Williamstown. On approaching the company with these proposals, the company said they would only construct them on the understanding that a nominal rent should be paid, and that when the time came for acquiring the lines it should be as a going concern and not under the 1870 Act. The Council had agreed to these conditions, and accordingly the Bill was now presented to Parliament, embodying the terms he had referred to. The cost of the new tramways would be £35,000. The opponents to the Bill were the Taff Vale Railway and the South Wales and Monmouthshire Coal Traders' Association.

Mr. W. P. Nicholas, Clerk to the Council, gave evidence bearing out counsel's statement.

Mr. Robt. Hammond, consulting engineer to the company, gave evidence in support of the scheme.

The opposition of the Taff Vale Railway was proceeded with on Wednesday, when Mr. Lloyd, who represented the company, stated that they took the view that the lines were not necessary. If the Committee thought it right in the public interest to authorise the extensions, then the opponents asked that the terms already agreed upon should not be set aside.

Mr. Owen Beaseley, general manager of the Taff Vale Co., gave evidence against the Bill.

The Committee having consulted together in private, the Chairman said they had come to the unanimous decision to give the powers asked for, and to assent to the terms agreed upon between the Urban District Council and the Tramway Co.

Farnham Gas and Electricity Bill.—The Select Committee of the House of Commons, presided over by Mr. Alfred Emmott, on Thursday of last week had the above Bill before them. Mr. Seager Berry, Parliamentary agent for the promoters, said that, under the Bill, the company were asking powers to supply electrical energy in the urban district of Farnham and the parish of Farnham Royal. The company anticipated that, within three years, the electrical side of the undertaking would be able to show a profit. The company required £18,500 for the purpose of their electrical scheme. Mr. A. H. Dykes, consulting electrical engineer, gave evidence on behalf of the Bill. He said that he was also interested in the Ascot Gas Co., which had powers to supply electricity. The area of that company adjoined that of the promoters, and they carried a sum to the profit and loss account in the first operative year's working. He saw no reason why the present company should not do the same, for the conditions were alike. If anything, the prospects of the promoters were better, for their area was more concentrated than that of the Ascot Co. Formal evidence having been given in proof of the preamble, the Bill was ordered for Third Reading.

Bishop Stortford, Harlow and Epping Gas and Electricity Bill.—The Bill promoted for the amalgamation of the three above-named undertakings, together with the extension of their areas, came before the Unopposed Bills Committee of the House of Commons on Thursday of last week. Mr. Seager Berry, the Parliamentary agent for the promoters, explained that the companies concerned were really gas undertakings, but they were asking powers to supply electricity. The Bishop Stortford Urban District Council, in 1905, obtained an order for supplying electricity, but on looking into the matter they did not think it would be a financial success, and they did not proceed with the scheme. They, however, sold their order to a company for £250. There, again, the matter was brought to a standstill, for the company did not consider it expedient to go on with the proposal. The promoters now came to Parliament, and in their Bill they stated that if the U.D.C. would not go with the scheme, then they (the promoters) should be allowed to have the powers. The U.D.C. opposed the Bill when it was before the House of Lords' Committee, and after the parties had carefully considered the matter, an arrangement was come to. The promoters inserted a clause in the Bill, whereby the U.D.C. would have power to purchase the undertaking at the end of 21 years, with a recurring period of seven years. That, of course, took the place of the ordinary terms of acquisition under the Electric Lighting Acts, which were 42 years and 10 years respectively. Mr. J. F. C. Snell, consulting electrical engineer, gave evidence in support of the scheme. The consideration of the electrical proposals was adjourned for a week, in order to allow of a witness from the U.D.C. giving evidence as to the views of that authority on the Bill.

Wireless Telegraphy.—In Thursday's Parliamentary Papers Sir Owen Philipps asked the Postmaster-General whether the Bolt Head shore station for radio messages had instructions to give priority to Marconi messages to the detriment of other systems, in view of complaints received that no message could be lodged at that station by another system between the night of Friday, April 1st, and 10.30 p.m. on Saturday, April 2nd.—Mr. Herbert Samuel replies that no such instructions had been issued, and there is no ground whatever for the suggestion that priority is given to traffic from ships equipped with any particular system of wireless telegraphy.

Progress of Bills.—In the House of Lords, on April 25th, the North-East London Railway Bill and the London United Tramways Bill were read a second time, and the Wimbledon and Sutton Railway Bill was read a third time and passed.

NEW ELECTRICAL DEVICES, FITTINGS, AND PLANT.

Self-Regulating Searchlight Generator.

Messrs. Mather & Platt, Ltd., of Park Works, Manchester, have recently placed on the market a dynamo which generates current at practically constant value throughout a range of pressure far beyond that required for arc lamp working. The regulation is entirely automatic, and the terminals can be short-circuited without

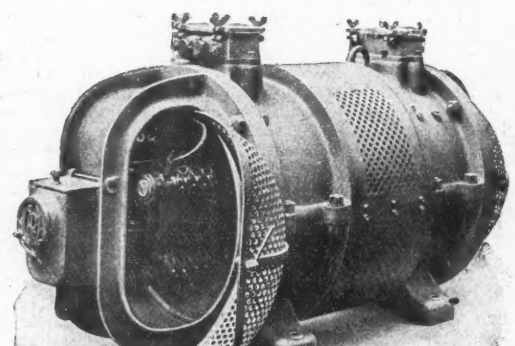


Fig. 1.—M. & P. Searchlight Generator and Motor.

appreciable current variation. The current can, however, be varied by altering the excitation, thus allowing the generator to be used for lamps of varying current requirements—for instance, a 15-amp. or 25-amp. projector can be run off the same machine.

The use of such a machine simplifies the management of the projector; current is switched on by closing the dynamo circuit, and an arc is drawn out to the correct length, either automatically by the projector or by hand regulation.

The dynamo voltage accommodates itself to the condition of the arc, and it is possible to draw out an arc 25 to 40 mm. long with a 50-amp. current. Fig. 1 shows a view of the machine coupled to a driving motor.

Horvath Tungsten Lamps.

Much trouble has been experienced in the arrangement of th filaments of tungsten lamps, the relatively low specific resistance of the metal necessitating the use of filaments five times as long as carbon filaments, mounted in pear-shaped bulbs, for which existing fittings are not well adapted. To get over this difficulty, smaller bulbs have been adopted, but in these the filaments are somewhat crowded, so that after burning a short time, they sometimes touch and cut each other out. When this happens the filaments are considerably over-run, and the life of the lamp is greatly reduced.

To solve these difficulties Mr. S. Horvath has introduced a new arrangement of the filaments, which is protected under Patent No. 7,373; this is shown in the accompanying plan, and consists of a double-framed crossed filament; it will be noticed that every

second arm from the leading-in wire *a* is short, whilst the outside arm *b* projects to such an extent as to prevent the filaments from causing short circuit. Again, the filaments are arranged in two rows, which provide a greater space for their distribution, and prevent magnetic attraction from acting upon them whilst in a glowing

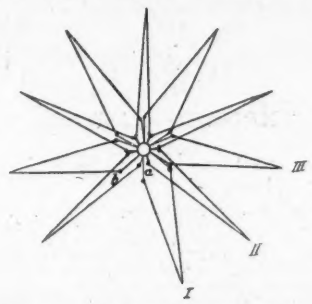


Fig. 2.—Horvath Arrangement of Filaments.

state, as the space between them is twice as large as if they were all at the same radius. This arrangement enables Mr. Horvath to manufacture lamps with the tungsten metallic-filament in very small bulbs, where otherwise it would be impossible.

The sale of these new lamps is in the hands of Messrs. Galsworthy, Ltd., of 15, Newman Street, W.

E.A.C. Current Limiter.

The accompanying illustration shows a new current limiter recently brought out by the Electrical Apparatus Co. Ltd., of Milford Works Queen's Road, Battersea, S.W., for use on small installations supplied on a contract basis. The device consists of an electro-magnet and resistance connected in series with the lamps, the former being regulated so that the armature is pulled over at a given current. In the normal position, the resistance is short-circuited by a contact made by the armature, and the movement of the latter, when the maximum current contracted for is exceeded, of course inserts the resistance and makes the lamps burn dimly, reducing the current below the maximum value, so that, even if the lamps are allowed to continue burning dimly, no loss will be incurred. Adjustments can be made, and terminals are provided inside the case for a fuse to be inserted, if desired. The whole is of simple construction, and is enclosed in a cast-iron case.

The firm are now offering also enclosed fuses of any size, to fit any centres, and of any current-carrying capacity, from stock, having put a large stock in hand of their well-known patent Koolark fuses, which have been standardised and are being made in large quantities with special machines. They have received the sole contract for 2½ years for the supply of fuses of 30 amperes and upwards to the Admiralty.

Ceiling Rose for Open Wiring.

We have received from Mr. Stanley Johnson, of Queen Street, Belfast, a sample of an ingenious ceiling rose which he has lately patented, and which is particularly adapted for surface wiring. It consists of a porcelain base and sub-base, clamped together and to the ceiling block by two screws. The surface wires lie in parallel slots, 1½ in. apart, between the base and sub-base, and are bared for about ½ in. of their length at the centre of the porcelain. The

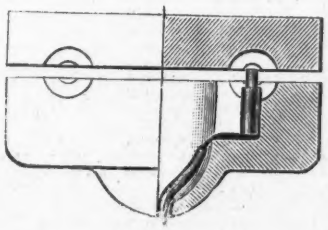


Fig. 4.—Johnson Ceiling Rose.

lamp flexible passes up through the centre of the lower porcelain, the two ends, bared, being inserted in holes on either side which register with the slots for the surface wiring. In the holes are inserted a couple of spring plungers, such as are used in lamp sockets, and which, when compressed by the clamping together of the porcelains, make contact top and bottom with the bared wires. If properly inserted, the flexible cannot be pulled away without breaking. The device, which will be understood from the accompanying figure, is extremely simple, and not likely to be affected by vibration.

FOREIGN AND COLONIAL TARIFFS ON ELECTRICAL GOODS.

NORWAY.—The following duties are payable:—

	Kroner per kg.
Accumulators and parts thereof, including cells; electric cables and wires; insulators, telegraphic and telephonic, of all kinds	Free.
Galvanic elements and parts thereof, including cells	·10
Incandescent electric lamps	1·50
Carbons for electrodes and electrode carbons prepared for industrial purposes, not including parts for galvanic cells or carbons for arc lamps	Free.
Carbons for arc lamps	15 % ad val.
Electrical apparatus not specially mentioned, including telephone and telegraph instruments, switchboards and parts thereof, and arc lamps (the globes are dutiable according to the component material)	·70
Glassware not specially mentioned in the tariff ...	·35
India-rubber and gutta-percha, manufactured:	
Sheet, including rubbered paper, cords or thread, rope, blocks, buffers and roller, even when in combination with thread or tissues	Free.
Other, except rings, machine packing, mats, goloshes, footwear, &c.	1
Machine packing	30

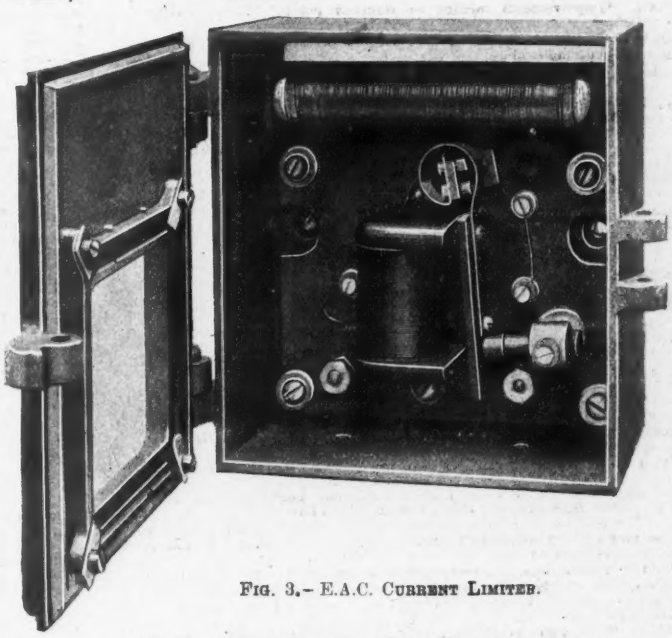


Fig. 3.—E.A.C. Current Limiter.

Technical apparatus, such as tachometers, indicators, electrometers, voltmeters, ammeter, wattmeters, galvanometers and insulation testers ...	10 % ad val.
Other instruments not specially mentioned ...	Dutiable as manufactures of the component material.
Troughs and open ducts, of earth or clay	Free.
Lamps and parts of lamps (excepting counterweights, chimneys, globes and shades, which are dutiable separately), candelabra, brackets, and parts of the same:	
Gilt, silvered or plated	1
Copper, brass, bronze or nickeled, or of nickel alloy	·50
Other	·35
Machines, motors and apparatus for industrial or other technical purposes, for shipbuilding or engineering, not specially mentioned in the tariff*†	10 % ad val.
Machine or transmission belting†	8 % ad val.
Machine packing and engine cables	Free.
Steel sleepers, rails, wheels, springs, &c., for railways and tramways; iron or steel wire, unwrought, coated or not	Free.
Copper manufactures not mentioned in the tariff ...	·50
Electrical apparatus for use in submarine mines ...	Free.
Railway carriages, motor carriages of all kinds ...	12 % ad val.
Dynamos, motors and transformers, cut-outs, frame rheostats and safety apparatus, electric lamp switches with or without commutators*† ...	10 % ad val.

*N.B.—If these articles are made with iron plates 3 mm. or upwards in thickness, they may be imported duty free.

† These goods may be admitted free of duty if proved to be of a class or kind not manufactured in Norway.

Krone = 1s. 1½d.; kg. = 2·204 lb.

NEW PATENTS APPLIED FOR, 1910.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by Messrs. W. P. Thompson & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

8,698. "Improvements in electric lamps." B. Pordes. April 11th.

8,711. "Improvements in electric resistance furnaces." A. Peterson. (Application for Patent of Addition to No. 6,035/10.) April 11th. (Complete.)

8,729. "New or improved electrically operated speed-gear indicator." J. E. Temple. April 11th.

8,730. "New and improved method of and means for counting the evolutions of revolving parts by the employment of an electric current." J. E. Temple. April 11th.

8,744. "Improved lock for electric alarm purposes generally." J. G. Reilly. April 11th. (Complete.)

8,743. "Improved electrically installed alarm or tell-tale drawer, till or box, for money and valuables generally." J. G. Reilly. April 11th. (Complete.)

8,764. "Electrical indicator for giving notice when a break occurs in a single circuit, such as burglar alarms and the like." E. J. Deane. April 12th.

8,810. "Improvements in galvanic batteries." Dura Elementenbau G.m.b.H., and A. Lessing. (Application for Patent of Addition to No. 23,622/04.) April 12th. (Complete.)

8,827. "Improvements in or relating to coin-freed electric alarm bells." J. Grath and H. Drexler. April 12th. (Complete.)

8,828. "Improvements in and connected with electrical switches." J. Barnes. April 12th.

8,831. "Improvements in or relating to the suspension of trolley wires." M. Jellinek and J. F. de Tovaros. (Date applied for under Sec. 91 of the Act, July 19th, 1909, being date of application in Hungary.) April 12th. (Complete.)

8,834. "Improvements relating to tramway points." R. A. Hadfield. April 12th.

8,858. "Improved earthing device for electric switches." J. J. Rawlings. April 12th. (Complete.)

8,862. "Apparatus for actuating conduit traps and car ploughs for electric conduit tramways." D. Samaia. April 12th. (Complete.)

8,863. "Safety apparatus for actuating points of tramway lines from the car platform." H. Septon-Jones. (Société pour l'Exploitation des Brevets d'Aiguillage Samaia, Belgium.) April 12th. (Complete.)

8,913. "Improvements in electric incandescent lampholders to prevent them being taken out by unauthorised persons." W. P. Collins. April 13th.

8,922. "Improvements in prepayment electricity meters." Chamberlain and Hookham, Ltd., and W. S. Sprague. (Application for Patent of Addition to No. 3,250, 1910.) April 13th. (Complete.)

8,927. "Improved switch plug." S. A. Rouse. April 13th.

8,943. "Improvements relating to electric switches." C. H. Pearson. April 13th.

8,977. "Improvements in electrical plug connections." R. H. Davis and Siebe, Gorman & Co., Ltd. April 13th.

8,984. "Improvements relating to electrical incandescent lamps." British Thomson-Houston Co., Ltd., and J. Gray. April 13th.

8,988. "Improvements in and relating to the process of manufacture of bases for electric lamps." J. E. Criggal and British Vitrite Works, Ltd. April 13th.

8,991. "Improvements relating to illuminated advertisements, signs, and the like adapted to be secured to electric and gas arc lamps." H. W. Chinnery and F. A. Ackland-Snow. April 13th.

8,996. "Improvements in galvanic batteries." E. Anson, J. H. Henderson and J. C. Newlands. April 14th.

9,029. "Improved apparatus or mould for the purpose of the improved processes for the vulcanisation and devulcanisation of india-rubber, rubber compounds, or other hydrocarbon materials by cold electro-chemical action." E. M. Bailey, T. Middleton and B. Bailey. April 14th.

9,046. "Improvements in or relating to polyphase electric compensated series motor." Siemens Bros. Dynamo Works, Ltd. (Siemens Schuckertwerke G.m.b.H., Germany.) April 14th. (Complete).

9,071. "Improvements in covers for electric magnetic relays." G. H. Nash and Western Electric Co., Ltd. (Date applied for under Rule 13th, January 11th, 1910. An invention comprised in application No. 752, dated January 11th, 1910.) April 14th.

9,076. "Improvements in electrodes for electric arc lamps." Gebruder Siemens & Co. (Date applied for under Sec. 91 of the Act, May 14th, 1909, being date of application in Germany.) April 14th. (Complete.)

9,094. "Improvements in means for protecting tubes and vessels from galvanic or electric currents." C. Politz. (Date applied for under Sec. 91 of the Act, April 22nd, 1909, being date of application in Germany.) April 14th. (Complete.)

9,097. "Improvements in or relating to controllers for electric motors." Adams Manufacturing Co., Ltd. (Cutler-Hammer Manufacturing Co., United States.) April 14th. (Complete.)

9,101. "Improvements in and relating to means for starting and controlling electric motors." Adams Manufacturing Co., Ltd. (Cutler-Hammer Manufacturing Co., United States.) (Complete.)

9,103. "Improvements in electric arc lamps." H. J. Booker, A. Ogilvy-Webb, and R. C. A. Reinecke. April 14th.

9,117. "Improvements in electric light therapeutic appliances." N. Woodhouse and W. S. Rutherford. April 15th.

9,129. "Improvements in apparatus for electro-plating." M. Walker and A. G. Seaman. April 15th.

9,185. "Improvements in transmitting and recording telegraph and semaphore messages." B. S. Weston. April 15th.

9,153. "Improvements in or relating to electric switches, cut-outs, and the like." W. A. Trier. April 15th.

9,164. "Improvements in or relating to electrical signalling apparatus." C. Snow and J. E. Radley. April 15th. (Complete.)

9,171. "Improvements in or relating to controllers for electric motors." Adams Manufacturing Co., Ltd. (Cutler-Hammer Manufacturing Co., United States.) April 15th. (Complete.)

9,176. "Improved preparation to be employed in making electrolyte for primary batteries." B. E. R. Newlands and R. M. Parkinson. (Application for Patent of Addition to No. 11,926, 1909.) April 15th. (Complete.)

9,182. "Improvements relating to fireproofed electric cables, acid-proofed electric cables and the like." Anchor Cable Co., Ltd. April 15th.

9,191. "Improvements in electric arc lamps." H. J. Booker and A. Ogilvy-Webb. April 15th.

9,199. "Improved method of and means for controlling electric motors." Adams Manufacturing Co., Ltd. (Cutler-Hammer Manufacturing Co., United States.) April 15th. (Complete.)

9,208. "Improvements in or relating to the electro-deposition of iron." S. O. Cowper-Coles. April 15th.

9,209. Improvements in and relating to electric arc lamps." Allgemeine Elektricitats-Ges. (Date applied for under Sec. 91 of the Act, April 22nd, 1909, being date of application in Germany.) April 15th. (Complete.)

9,232. "Improvements in means for automatically varying the power of an explosion-motor combined with an electric machine." S. Missotten. April 16th. (Complete.)

9,225. "Improvements in electric arc lamps of the projector type." W Minster Engineering Co., Ltd., and A. G. Way. April 16th.

9,276. "Improvements in or relating to controllers for electric motors." Adams Manufacturing Co., Ltd. (Cutler-Hammer Manufacturing Co., United States.) April 16th. (Complete.)

9,278. "Improvements in devices for controlling the speed of electric motors." Adams Manufacturing Co., Ltd. (Cutler-Hammer Manufacturing Co., United States.) April 16th. (Complete.)

EXPIRING PATENTS.

(*Continued from page 672.*)

5,673. March 13th, 1896. "Electro-deposition." A. S. Elmore, Leeds. (J. O. S. Elmore, Punjaub, India.) Relates to apparatus for purifying metals by electrolysis. The arrangement is described for use in refining copper. Upon a wooden frame is placed a sheet of metal upon which a smaller sheet of the copper to be purified is placed. A rectangular wooden frame is placed upon the sheet of metal, and a number of rubber pads on the smaller sheet. Another lead sheet is then put down and another sheet of copper, and so on till a column sufficiently high is formed, and the whole is then bolted together. The top plate has a charging opening for liquid, as copper sulphate solution, the bottom plate an outlet therefor, and the intermediate plates openings alternately at either end. The top plate forms the cathode, the bottom plate the anode. The impure copper is absorbed, and the pure copper is deposited upon the underside of the lead plate just above. The impurities which collect in the liquid may be withdrawn by filtration.

6,329. March 21st, 1895. "Lighting and heating vehicles." E. J. Preston and A. B. Gill, both of Kent. Relates to apparatus for lighting and heating railway and other vehicles by means of electricity, being improvements upon that described in specification No. 1,611, A.D. 1895. The dynamo is suspended from the underframe by a link, which can be swung and adjustably fixed. The link, instead of being fixed to the frame, may be attached to a sliding block, or the dynamo may be pivoted to the block. When storage batteries are used in the system, there should be two sets, one set being charged by the dynamo, and the other ready to supply current.

6,579. March 25th, 1896. "Telephonic apparatus." A. Graham, London. Telephones are mounted in a case, the receiver being placed above the transmitter. A shutter covering the openings to both instruments is capable of partial rotation, and is restored to its normal position by springs. A gear-wheel is mounted on the shutter spindle, and gears with a wheel insulatingly mounted on the back of the transmitter. The transmitter is of the Hunning's type, whilst the receiver one is arranged preferably in accordance with the invention described in specification No. 14,516, A.D. 1893.

7,783. April 13th, 1896. "Electrodeposition." W. P. Thompson, Liverpool. (E. Wohlwill, Hamburg.) Relates to obtaining chemically pure gold by electrodeposition. Consists in employing currents of high density and electrolytes of a hot solution (50-70° C.) of gold chloride containing an excess of hydrochloric acid, or of sodium or other chloride capable of forming double chlorides with gold chloride. By these means no free chlorine is given off. When using auriferous alloys, gold chloride solution must be added to keep up the strength of the solution. When using argentiferous gold, silver chloride forms on the anode, and must be periodically removed by mechanical means. When using plumbiferous gold, sulphuric acid must be added to the electrolyte, and the lead sulphate accumulating on the anode removed periodically by mechanical means.

(*To be continued.*)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of Messrs. W. P. Thompson & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1908.

Searchlights or Projectors. Siemens Bros. Dynamo Works, Ltd., R. Hird and H. Grimston. 27,960. December 23rd.

1909.

Electric Batteries. H. de Martis. 4,034. February 18th.

Telephony. S. G. Brown. 4,162. February 19th.

Means for Creating Sparks, applicable for Use in Gas Lighting and Similar Purposes. R. Wilson. 5,760. March 10th. (Post-dated September 10th, 1909.)

Enumeration of Telephone Calls. S. D. Williams. 6,447. March 18th.

Apparatus for Metering and Transforming Electrical Energy. E. Wilson and W. H. Wilson. 6,704. March 18th.

Control of Electric Motors. Allgemeine Elektricitäts Ges. 6,566. March 18th. (Date applied for under International Convention, March 18th, 1908. Application for Patent of Addition to No. 24,481 of 1907.)

Speed Indicators for Electric Motors. British Thomson-Houston Co. (General Electric Co.) 6,673. March 19th.

Polyphase Relays. Allgemeine Elektricitäts Ges. 6,675. March 19th. (Date applied for under International Convention, March 19th, 1908.)

Electrical Generating Sets Driven by Wind or like Fluctuating Power. J. G. Childs and T. C. Hill. 6,752. March 20th.

Solenoid Brakes for Electrically-Driven Carriages. G. Rizzo. 6,849. March 22nd.

Rotary Electric Transformers and Motor-Generators. Crompton & Co., J. C. Macfarlane and H. Burge. 7,060. March 24th.

Portable Electric Safety Lamps. T. W. B. Durant and R. W. A. Durant. 7,141. March 25th.

Sheathing of Electrical Conductors. H. W. Handcock, A. H. Dykes, J. J. Rawlings and W. Dieselhorst. 7,187. March 25th.

Secondary Batteries. J. Stone & Co. and A. H. Darker. 7,424. March 27th.

Connecting or Jointing of Electrical Conductors and means therefor. H. W. Handcock, A. H. Dykes and J. J. Rawlings. 7,593. March 29th.

Condenser Systems. Willans & Robinson, Ltd., and R. Izod. 7,809. April 2nd.

Discharge Gaps for the Production of Electric Oscillations. A. W. Sharman. 8,111. April 5th.

Through-Control Magnetic Switches for Electric Lighting Installations on Trains. W. N. Cochrane. 10,729. May 6th.

Combined Centrifugal Fan and Electric Motor. R. Maxaner. 15,659. July 5th. (Date applied for under International Convention, July 9th, 1908.)